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# Anechoic Chamber Test of the Electromagnetic Measurement System Ground Test Unit

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Prepared by

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**Anechoic Chamber Test  
of the  
Electromagnetic Measurement System  
Ground Test Unit**

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### Abstract

The Electromagnetic Measurement System (EMMS) will acquire data on electromagnetic (EM) environments at key weapon locations on various aircraft certified for nuclear weapons. The high-frequency ground unit of the EMMS consists of an instrumented B61 bomb case that will measure (with current probes) the localized current density resulting from an applied EM field. For this portion of the EMMS, the first system test was performed in the Anechoic Chamber Facility at Sandia National Laboratories, Albuquerque, New Mexico. The EMMS pod was subjected to EM radiation at microwave frequencies of 1, 3, and 10 GHz. At each frequency, the EMMS pod was rotated at many positions relative to the microwave source so that the individual current probes were exposed to a direct line-of-sight illumination. The variations between the measured and calculated electric fields for the current probes with direct illumination by the EM source are within a few db. The results obtained from the anechoic test were better than expected and verify that the high frequency ground portion of the EMMS will accurately measure the EM environments for which it was designed.

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### Background

Many of the aircraft deployed by the Armed Services today utilize sophisticated Electronic Warfare (EW) systems to evade detection. Some systems are passive, such as aircraft shapes that use radar cross-section reduction techniques, but many are active; they use the transmission of electromagnetic (EM) waves. The active EW systems usually deny information (i.e., range and speed) to an opposing radar via Electronic Countermeasures (ECM) techniques. Over the years of ECM development, these techniques have become more sophisticated. The transmitted power and frequencies of the emitters have increased tremendously. During a "go to war" situation, these aircraft, if authorized, would operate both their ECM systems and nuclear gravity bombs simultaneously. Sandia has the responsibility to insure that the reliability and safety features of the bombs remain intact under these crucial circumstances. In order to make good technical judgments in this area, Sandia must have obtained measured data on the actual EM environments created by these ECM systems or other high-powered emitters illuminating a nearby nuclear weapon. Our EM Measurement System (EMMS) is a data acquisition tool that will accomplish this task.

### Objective

The EMMS is designed to provide a practical means of relating the EM environment at weapon locations created by ECM pods or other high-powered radiators to field levels that the weapons were designed to operate in. To accomplish this, the B61 bomb shape is used as the sensing device (used as an antenna) to sense EM fields. The induced surface currents on the case are measured with high frequency probes. These current probes respond to the localized current density that can be related to the equivalent EM free field impinging on the B61 bomb case. Our primary objective is to demonstrate the effectiveness of this unit with a laboratory test simulation. Eventually, we want to use the EMMS as an electromagnetic compatibility tool for testing nuclear certified aircraft's EM emissions at bomb locations.

### Approach

The plan for the overall system will consist of four instrumented B61 bomb cases. Two units will be deployed for ground test and two for airborne test. Each deployment phase covers 10 kHz to 50 MHz with one bomb case, and 50 MHz to 26.5 GHz with the other. The instrumentation inside the ground units is controlled by a computer that resides in an instrumentation trailer. This trailer was designed to attenuate high ambient EM fields (for health hazards and equipment) on the flight line during a test, as well as supply AC power to the instruments and transfer various digital signals between the unit and the computer via fiber optic cables.

### Anechoic Chamber Test

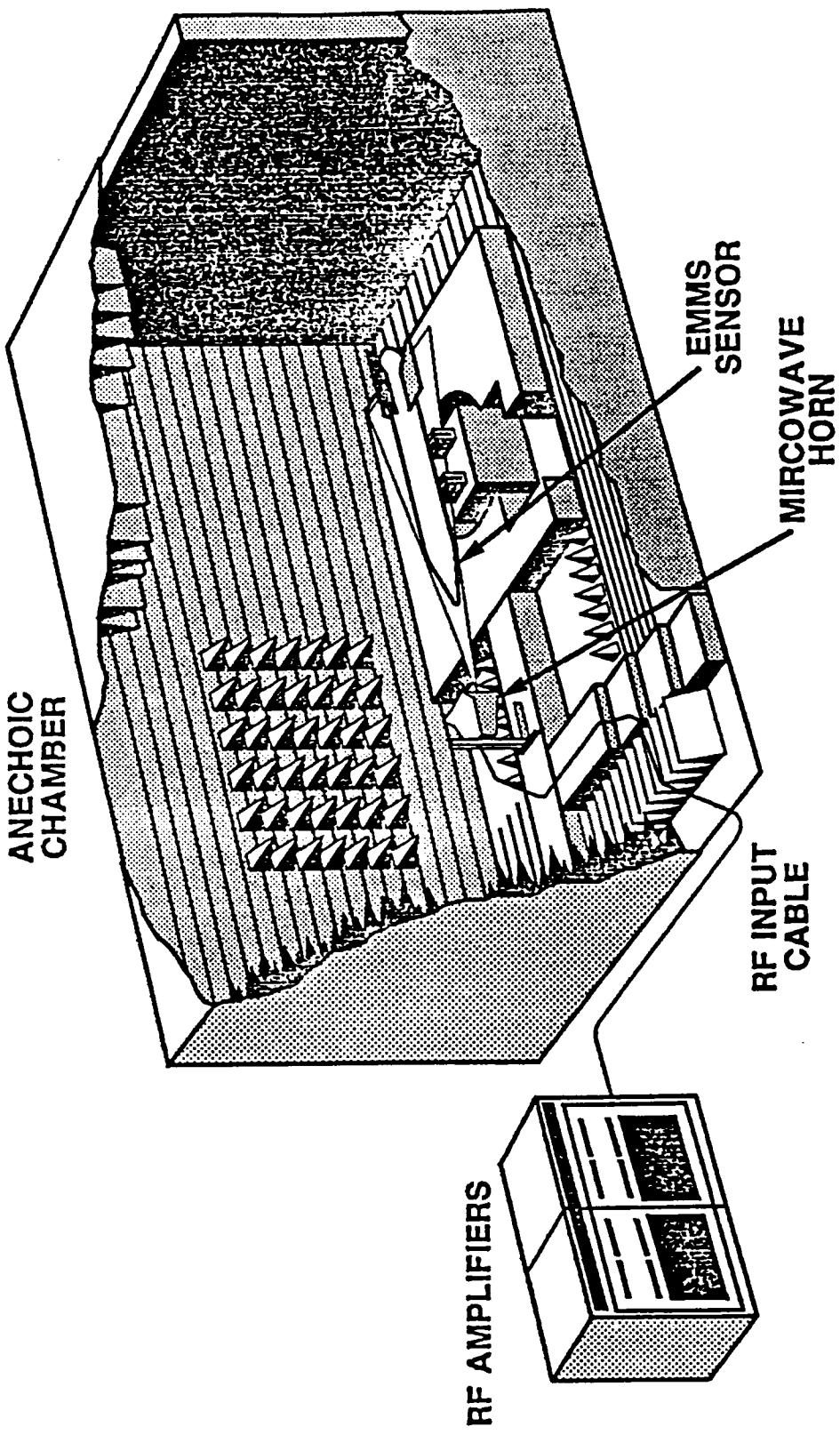
The prototype of the High Frequency (50 MHz to 26 GHz) Instrumented Case used for ground testing is completed. This report describes the in-house laboratory test performed in the Anechoic Chamber of Building 872 during September and October, 1986. The purpose of this test was to evaluate the system operation (both hardware and software) when this unit was exposed to a known level of EM radiation emanating from a microwave transmitter. In this report, we will present the data obtained from that experiment and evaluate the overall system performance.

### Test Arrangement

During the test, the instrumentation trailer was parked outdoors near the southwest end of Building 872. The power and communication cables going to the sensor were routed around the building through a hole in the wall, then along the wall to the signal patch panel of the Anechoic Chamber.

Figure 1 illustrates the basic test arrangement of our high frequency ground unit with the Anechoic Chamber Facility. The sensor (ground unit) was placed in the center of the chamber (on foam and wooden mounts) on a rotatable platform. The relative location of the current probes mounted to the surface of the sensor and the arrangement of the internal electronic instruments are shown in Figures 2 and 3, respectively. The instruments within the sensor are controlled from the trailer by the HP-9000/520 computer over

# EM MEASUREMENT SYSTEM CHECK OUT



87TA5000.32

Figure 1

# HIGH FREQUENCY GROUND UNIT

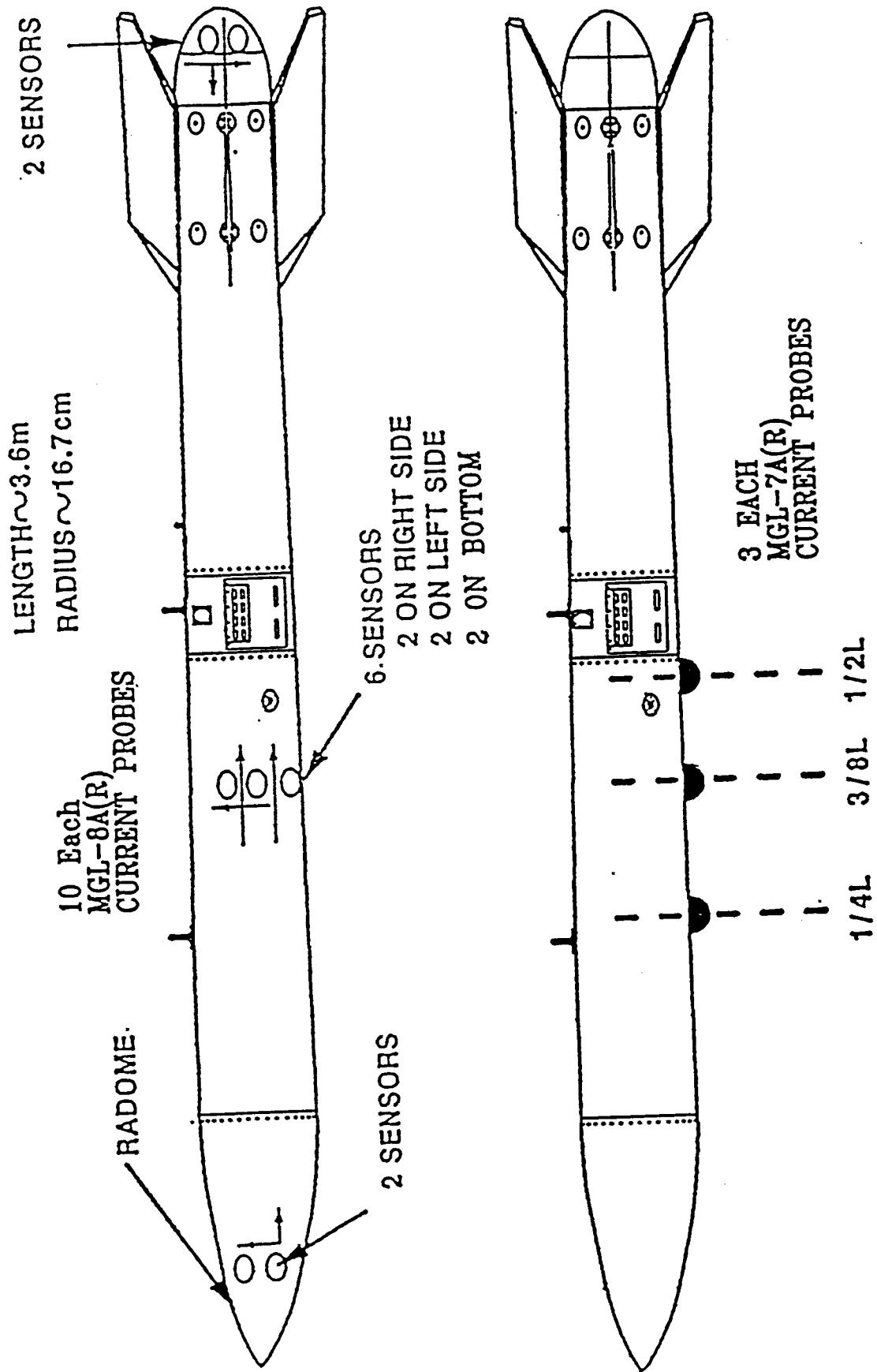


Figure 2

# EM MEASUREMENT SYSTEM HIGH FREQUENCY GROUND CASE

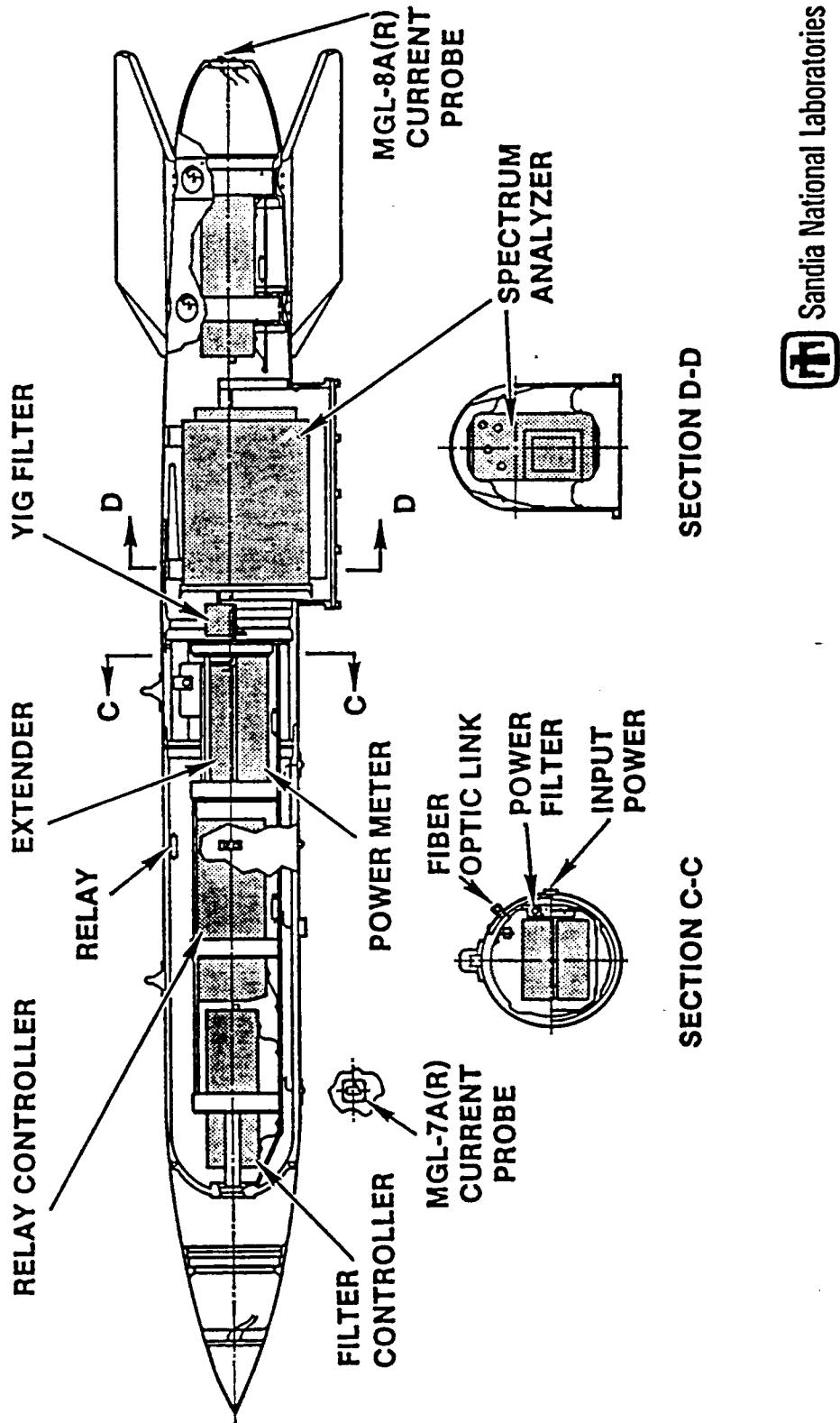


Figure 3

a fiber optic IEEE-488 interface extender. The test control software closes relays that route the signal from each antenna to the spectrum analyzer or power meter. Data is displayed at the computer system console, its internal printer, and stored in files on hard disc.

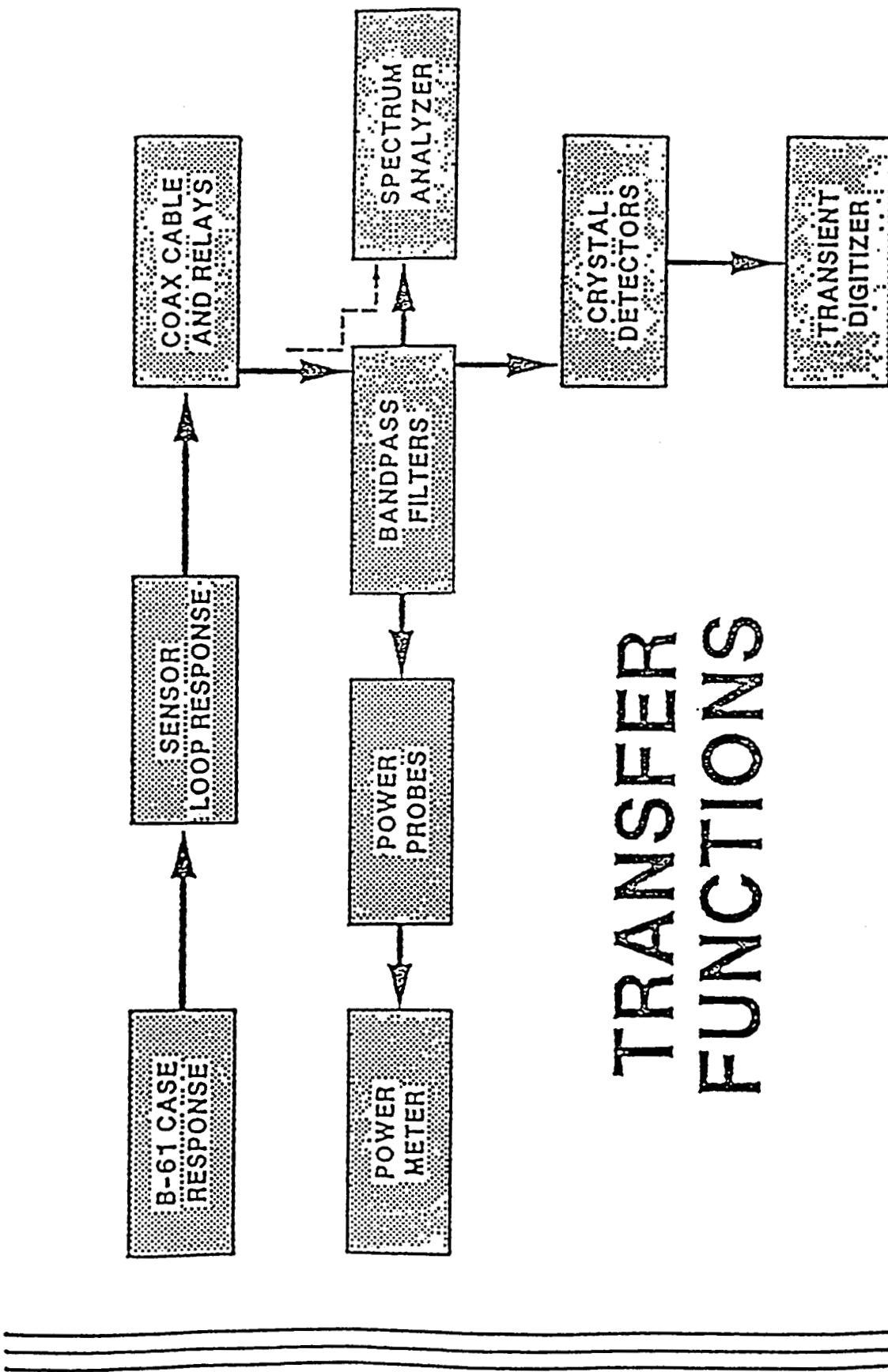
### Microwave Equipment

Standard test signals were produced by one of three laboratory traveling wave tubes (TWTs), which are part of the normal complement of equipment used with the Anechoic Chamber. These TWTs produce pulse signals with 1 KW of power, a 2-microsecond pulse width, and a pulse repetition rate of 5 KHz. The output of the TWTs is fed to a microwave horn that illuminates the sensor. The microwave horn was placed two meters from a given antenna probe on the sensor. Power delivered to the horn by the TWT was monitored by a power meter and directional coupler from inside the trailer using a television video link. Once a warm-up time was achieved for this equipment, the TWT amplifier could operate continuously without maintenance or adjustment. The 1 KW signal from the TWT, together with the antenna gain and placement of the horn relative to the current probe, resulted in a field strength of over 300 volts/meter. This field strength is representative of the lower levels in a typical EMR STS requirement. The antenna gain of the horn was obtained from standard antenna patterns at the various test frequencies for the model used. Machining tolerances in manufacturing the horn dictates the validity of those antenna patterns. To determine the electric field impinging on the case, the measured transmitted power and specified antenna gain were used. When the EMMS is used during a flight line test, the ECM pod or other aircraft radiators would take the place of the microwave equipment just discussed. Under computer control, a Sandia-supplied signal generator would then cause the ECM pod to retransmit EM radiation at the supplied frequency and preferably with maximum output power. Because the TWTs were self-excited for this test, the software controlling the signal generator's emanation was not incorporated.

### Calibrations

The transfer functions between the impinging EM field and the data acquisition of the instruments were determined by three separate parameters. These parameters are the response of the B61 case to the incident signal, the sensitivity of the current probes, and the signal path loss between the current probes and the detectors. A block diagram of transfer functions for the major components of the High Frequency Ground Unit are shown in Figure 4. Upon satisfying this matrix, whether theoretical or measured, the signal measured by the instruments can be transformed into an equivalent electric field level arising from a plane wave in free space, rather than the actual complex fields at the weapons location. The response of the case to the EM field for these test frequencies were calculated numerically using a finite difference equation model. The sensitivity of the current probes were determined by their equivalent loop area using specified physical dimensions. This geometric structure of the current probes also determines the source impedance, and hence, the frequency response. For example, the cross-sectional or loop area of the MGL-8 is .00001 meters squared. Laboratory measurements made on the probes used for the EMMS show that a quasistatic analytical model is useful for calculating the frequency response well past the 3 db corner frequency. This is evident because of the manufacturing tolerances and clean probe design. The broad band frequency response (well beyond the 3 db corner frequency) determined by the probe loop inductance was observed with a calibration fixture designed to determine if any unexpected response existed. None were found. Since these observations provided only relative amplitude

Figure 4



frequency responses with no absolute calibration, the geometric or physical dimensional values were used in reducing the data from these tests<sup>1</sup>. To determine signal path losses, all paths between the current probes and detectors (spectrum analyzer and power meter) were characterized by a network analyzer.

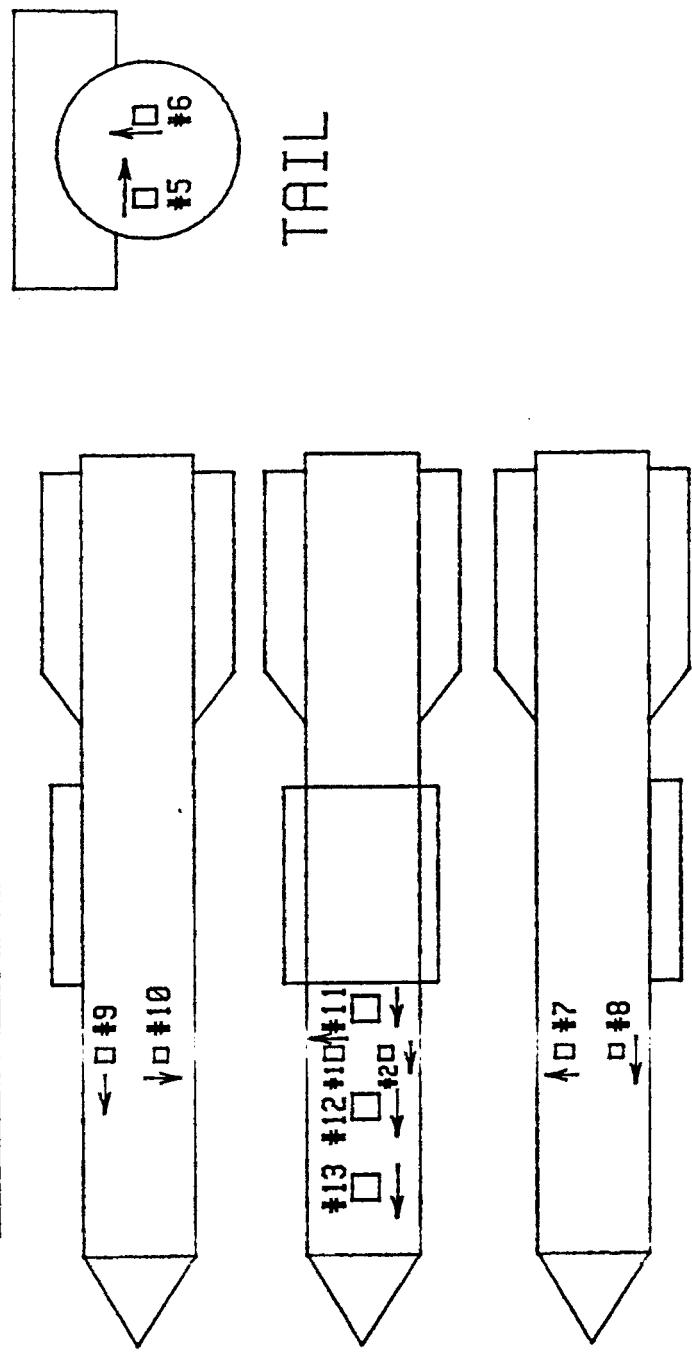
#### Power Meter Data Reduction

The bar charts shown in Graphs 1 through 28 of the Appendix represent the ratio of the measured to calculated electric field impinging on the sensor.

In summarizing these measured results, there were a total of 28 completed measurements. To interpret the bar chart results and make meaningful comparisons, one looks at Figure 5 for the sensor station, which is being illuminated directly by the plane wave emerging from the source horn along with the wave and sensor polarization (horizontal or vertical).

<sup>1</sup>Absolute probe calibrations may be performed to provide more accurate broadband response, if desired.

POD ANTENNA  
LAYOUT 10/6/86



MGL-7A(R)    MGL-8A(R)  
 $A = .0001 \text{ m}^2$     $A = .00001 \text{ m}^2$

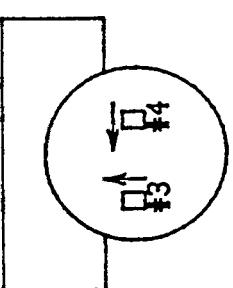


Figure 5

For those sensors being directly illuminated with the optimum polarization, we found the following statistics:

<u>Frequency</u>	<u>Number of Samples</u>	<u>Deviation</u>
1 GHz	5	+2 to -1 db
3 GHz	12	+2 to -3 db
10 GHz	11	-2 to -9 db

It should be noted that no attempt was made to correct the sensor responses for the known decrease in sensitivity at 10 GHz. In addition, the gain figures used to calculate the illumination fields are manufacturer's nominal values for the source feed horn. With this in mind, it is remarkable that the deviations displayed above are as small as they are. The deviations also demonstrate the drooping trend expected at the higher frequency.

Further examination of the bar charts will show that those sensors being illuminated with a polarization 90 degrees off their response characteristic are all down by 20 db at the lower two frequencies, and down by at least 12 db for the 10 GHz frequency. It was further noted that at 1 GHz, and many times for 3 GHz, the responses for both the MGL-8 and MGL-7 probes are in good agreement when the polarization and sensor locations were such that both models were in the direct illumination.

These latter observations confirm the need for the multiple locations and polarizations for the higher frequency band responses to insure reception of the maximum energy being

directed at the B-61 case from all reasonable angles. Also, they confirm the accuracy of the various pretest path loss calibrations and sensor response calculations used in the data reduction to express equivalent plane wave E-field illuminations. The cross-polarization responses, being down at least 12 db and usually greater than 20 db, point to the success in limiting the sensor response to that of the surface currents induced on the B61 case. This response characteristic enhances the accuracy of the measurements and their subsequent interpretation in relating equivalent plane wave E-field incidence on the instrument case.

### Conclusion

On a bonafide flight line test, the EMMS sensor will be loaded on an aircraft in the same weapon location as a war reserve B61 bomb. The ECM pod or emitter that radiates the most power at concerned frequencies will operate continuously while the instrumentation inside the sensor is measuring the EM environments. The Anechoic Chamber test demonstrated that the EMMS could successfully measure EM environments that represent the lower end of a typical ECM system and EMR Stockpile-to-Target requirement.

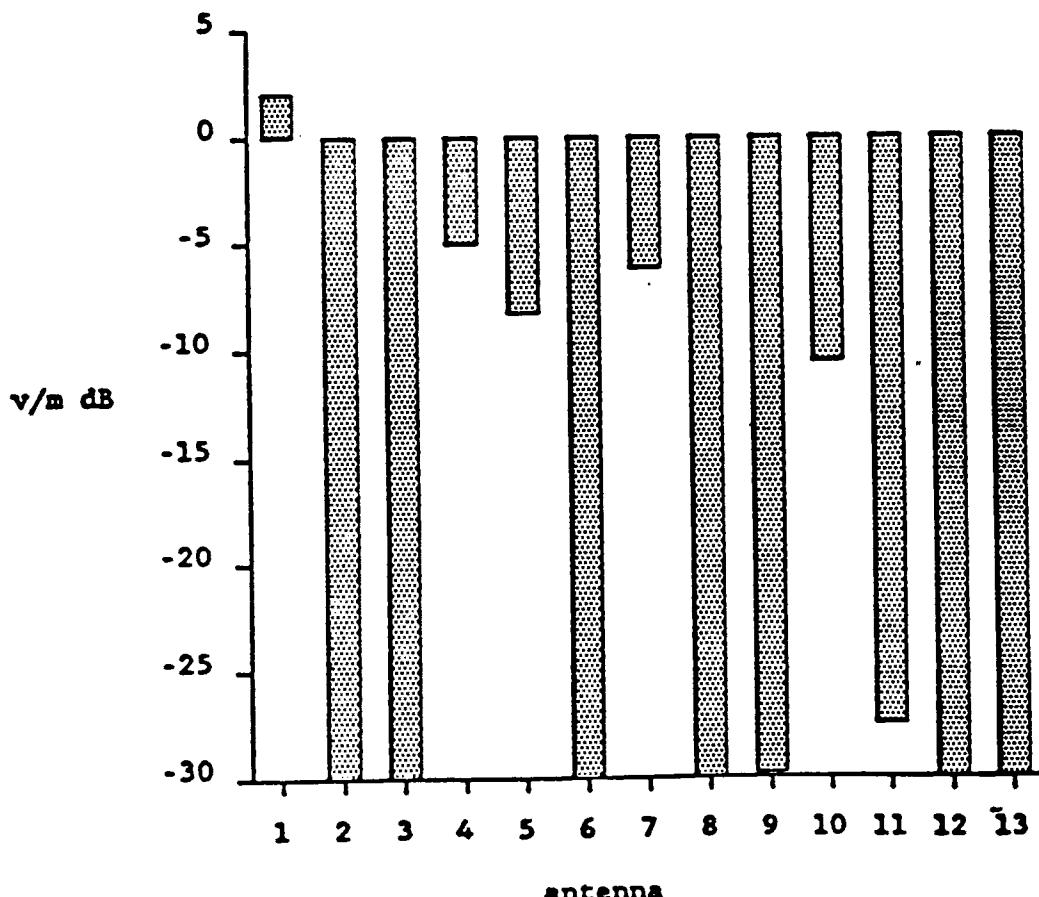
## **Appendix**

Graph 1

Test ID	Podtest3-8	1 GHz	2	
ECM Freq				
nearest ant				
horn rotat.				
antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-38.930	245.602	194.960	2.006
2	-100.000	0.217	194.960	-59.064
3	-75.370	4.263	194.960	-33.204
4	-47.150	108.951	194.960	-5.054
5	-50.290	75.202	194.960	-8.274
6	-100.000	0.246	194.960	-57.964
7	-47.210	95.660	194.960	-6.184
8	-100.000	0.225	194.960	-58.744
9	-70.990	6.320	194.960	-29.784
10	-51.950	58.107	194.960	-10.514
11	-49.490	8.178	194.960	-27.546
12	-62.690	1.724	194.960	-41.066
13	-64.710	1.346	194.960	-43.216

Podtest3-8

1 GHz



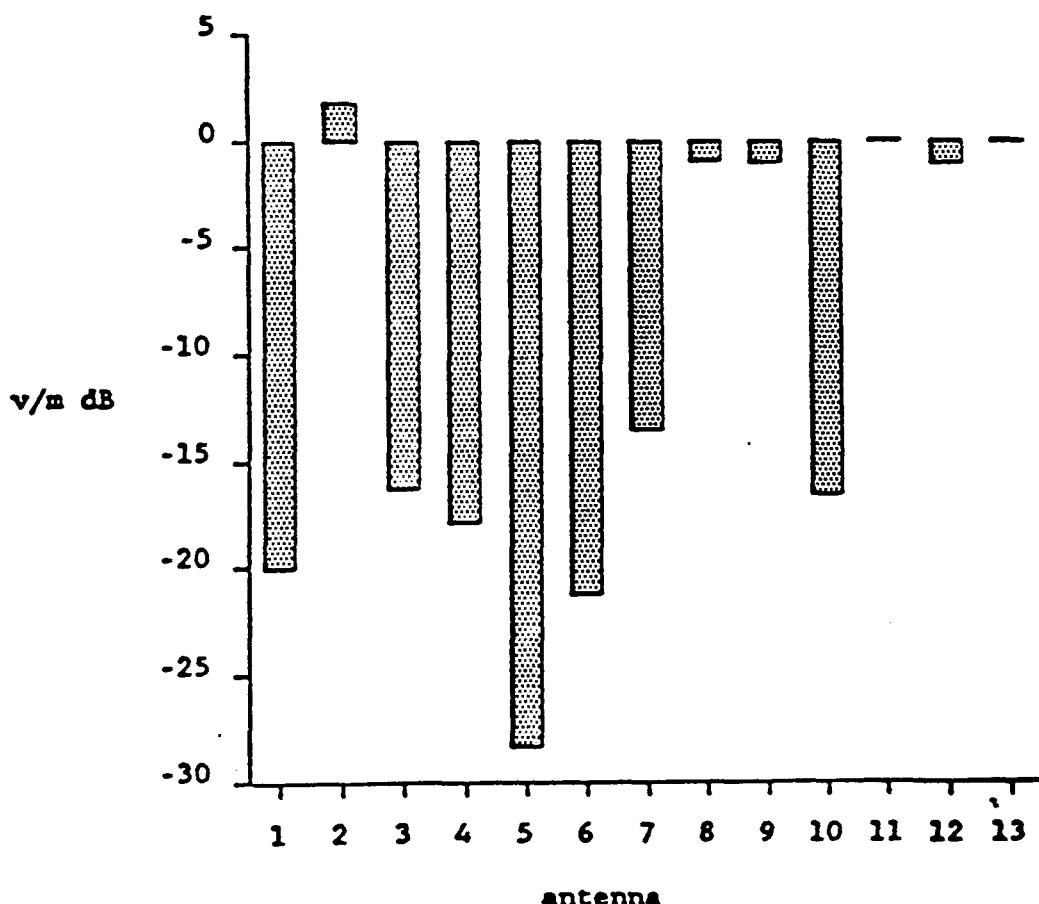
Graph 2

Test ID Podtest3-9  
ECM Freq 1 GHz  
nearest ant 2  
horn rotat. horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-61.020	19.308	194.960	-20.084
2	-39.130	240.011	194.960	1.806
3	-58.440	29.939	194.960	-16.274
4	-59.980	24.873	194.960	-17.884
5	-70.290	7.520	194.960	-28.274
6	-63.300	16.855	194.960	-21.264
7	-54.560	41.042	194.960	-13.534
8	-42.230	174.273	194.960	-0.974
9	-42.250	172.875	194.960	-1.044
10	-57.990	28.989	194.960	-16.554
11	-21.920	195.498	194.960	0.024
12	-22.730	171.650	194.960	-1.106
13	-21.590	192.816	194.960	-0.096

Podtest3-9

1 GHz



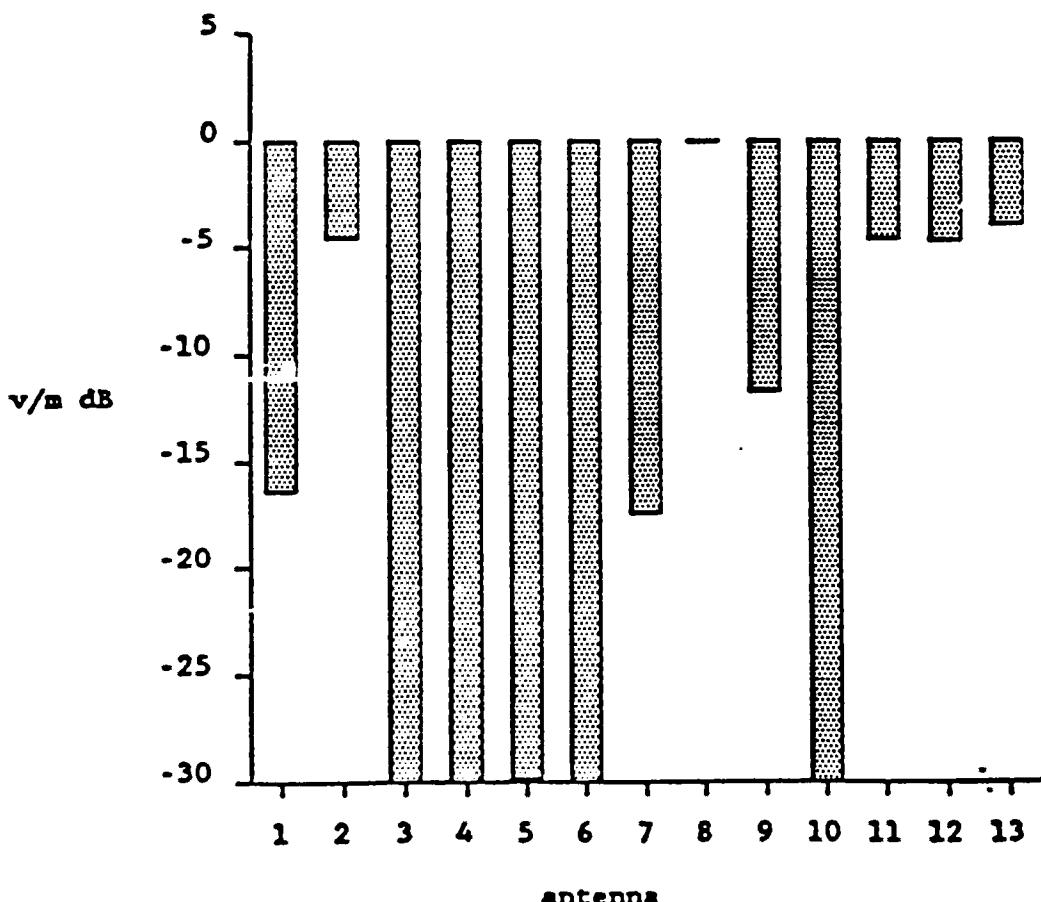
Graph 3

Test ID Podtest3-10  
ECM Freq 1 GHz  
nearest ant 8  
horn rotat. horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-54.790	39.558	262.388	-16.434
2	-42.910	155.321	262.388	-4.554
3	-71.450	6.695	262.388	-31.864
4	-100.000	0.248	262.388	-60.484
5	-69.310	8.418	262.388	-29.874
6	-100.000	0.246	262.388	-60.544
7	-55.860	35.337	262.388	-17.414
8	-38.760	259.855	262.388	-0.084
9	-50.340	68.113	262.388	-11.714
10	-100.000	0.230	262.388	-61.144
11	-23.970	154.399	262.388	-4.606
12	-23.790	151.930	262.388	-4.746
13	-22.870	166.396	262.388	-3.956

Podtest3-10

1 GHz



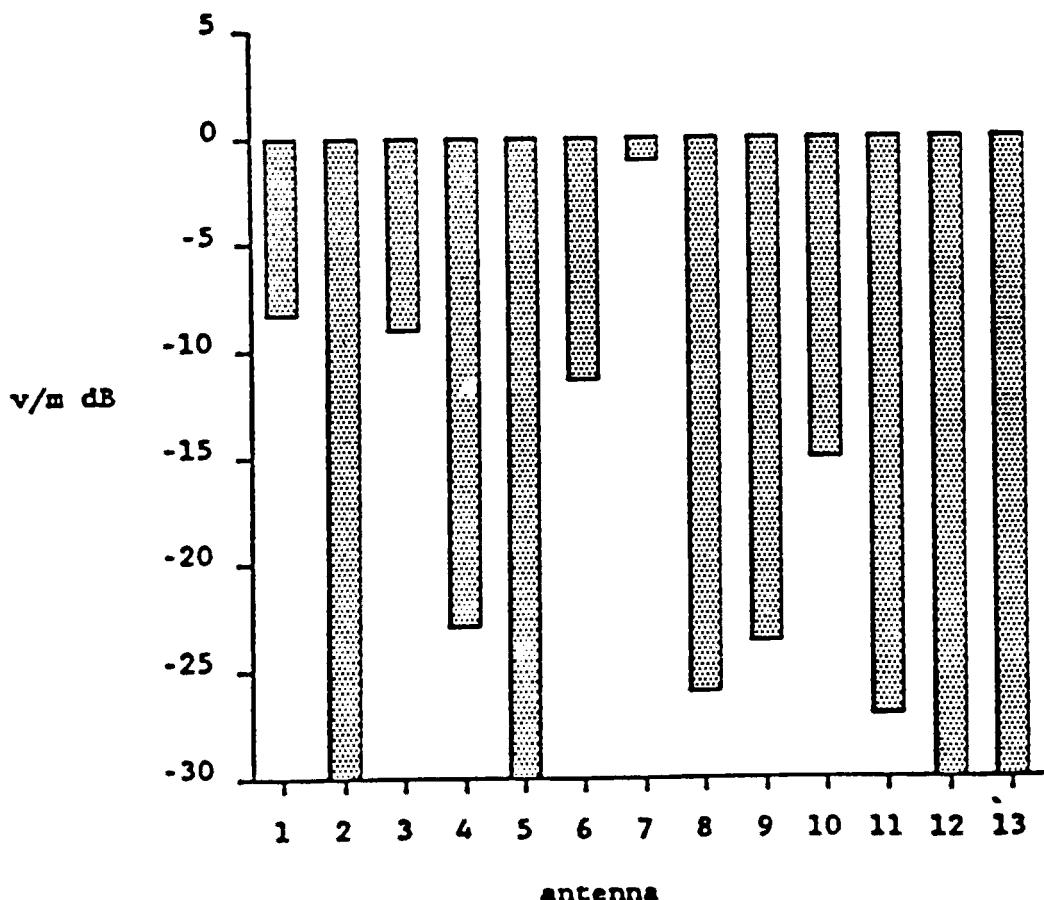
Graph 4

Test ID Podtest3-11  
ECM Freq 1 GHz  
nearest ant 8  
horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-46.740	99.938	260.582	-8.324
2	-100.000	0.217	260.582	-61.584
3	-48.700	91.882	260.582	-9.054
4	-62.500	18.609	260.582	-22.924
5	-100.000	0.246	260.582	-60.504
6	-50.860	70.588	260.582	-11.344
7	-39.610	229.473	260.582	-1.104
8	-64.710	13.099	260.582	-25.974
9	-62.330	17.129	260.582	-23.644
10	-54.000	45.891	260.582	-15.084
11	-46.470	11.578	260.582	-27.046
12	-53.920	4.733	260.582	-34.816
13	-49.690	7.588	260.582	-30.716

Podtest3-11

1 GHz



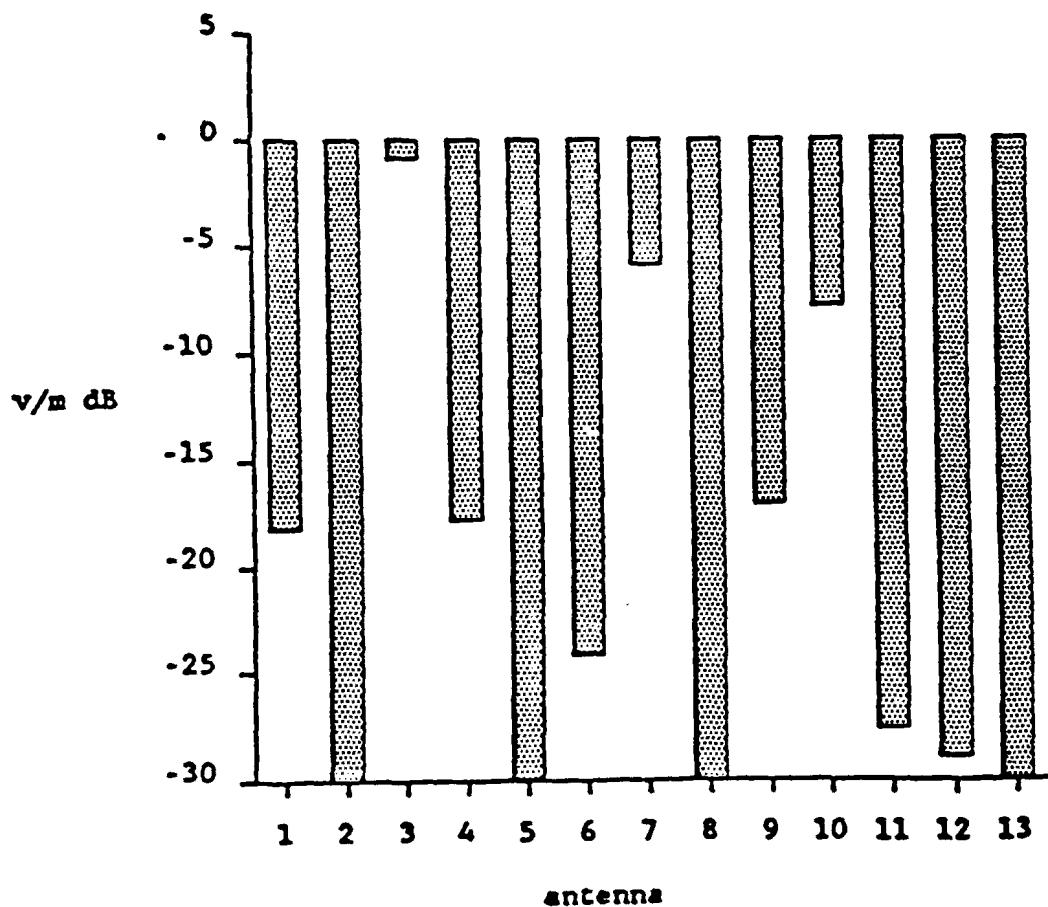
Graph 5

Test ID Podtest3-12  
 ECM Freq 1 GHz  
 nearest ant 3  
 horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-56.660	31.896	258.788	-18.184
2	-100.000	0.217	258.788	-61.524
3	-40.580	234.008	258.788	-0.874
4	-57.440	33.322	258.788	-17.804
5	-69.450	8.284	258.788	-29.894
6	-63.730	16.041	258.788	-24.154
7	-44.460	131.290	258.788	-5.894
8	-69.710	7.366	258.788	-30.914
9	-55.820	36.244	258.788	-17.074
10	-46.810	105.010	258.788	-7.834
11	-47.060	10.818	258.788	-27.576
12	-48.050	9.303	258.788	-28.886
13	-50.150	7.197	258.788	-31.116

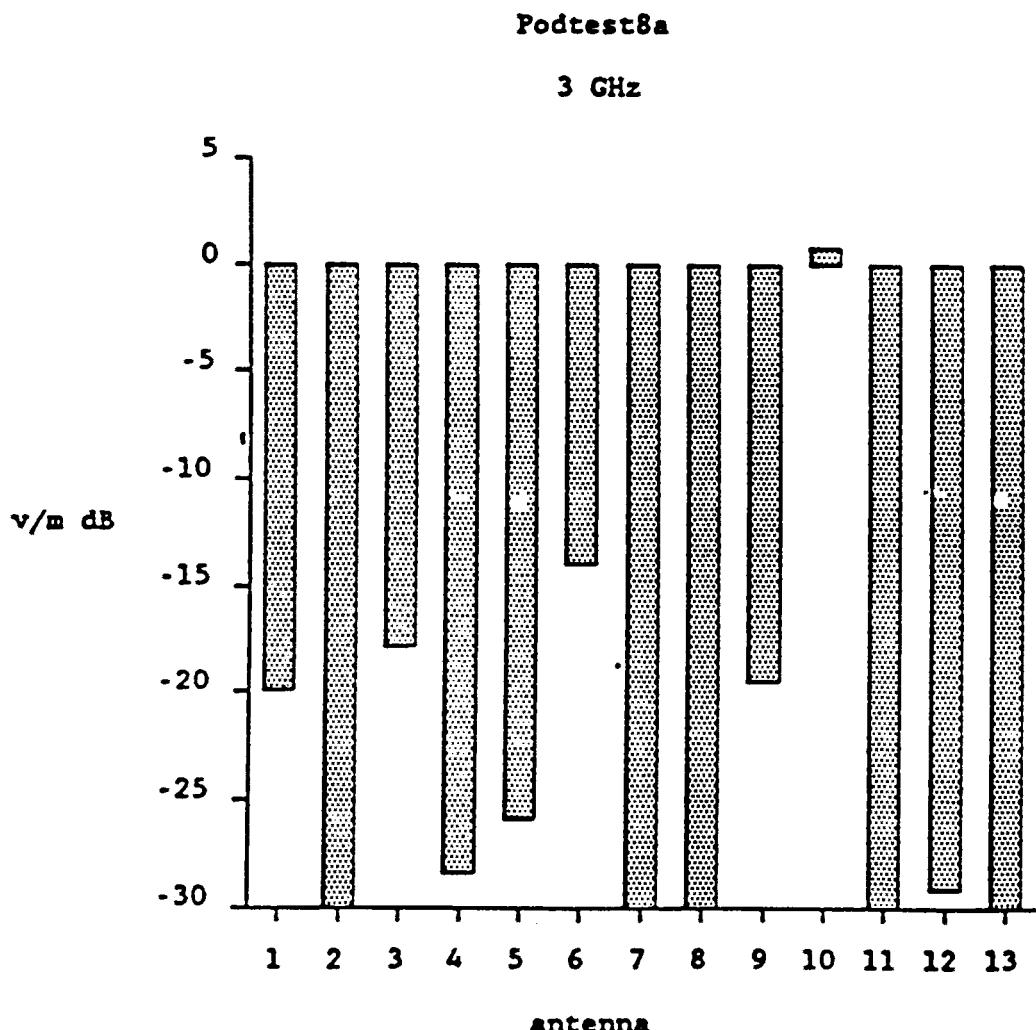
Podtest3-12

1 GHz



Graph 6

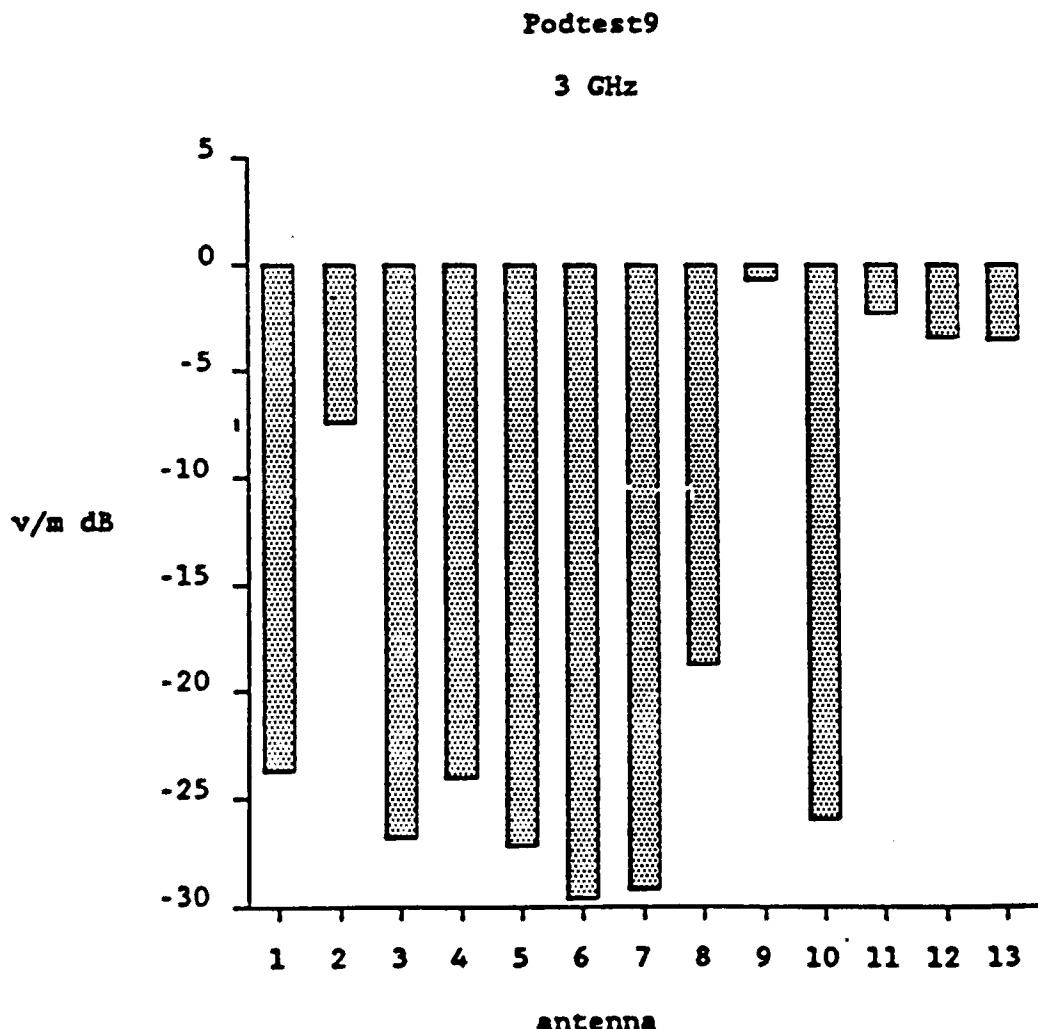
Test ID	Podtest8a	ECM Freq	3 GHz	nearest ant	9	horn rotat.	vertical
antenna	peak pwr	meas v/m	calc v/m	v/m dB			
1	-63.280	31.967	317.281	-19.935			
2	-100.000	0.466	317.281	-56.655			
3	-63.700	40.617	317.281	-17.855			
4	-74.200	12.126	317.281	-28.355			
5	-70.680	16.207	317.281	-25.835			
6	-59.270	63.856	317.281	-13.925			
7	-77.050	7.349	317.281	-32.705			
8	-100.000	0.523	317.281	-55.655			
9	-62.880	33.474	317.281	-19.535			
10	-43.600	345.703	317.281	0.745			
11	-62.400	5.793	317.281	-34.771			
12	-56.250	11.102	317.281	-29.121			
13	-60.860	6.530	317.281	-33.731			



Graph 7

Test ID      Podtest9  
ECM Freq      3 GHz  
nearest ant      9  
horn rotat.      horizontal

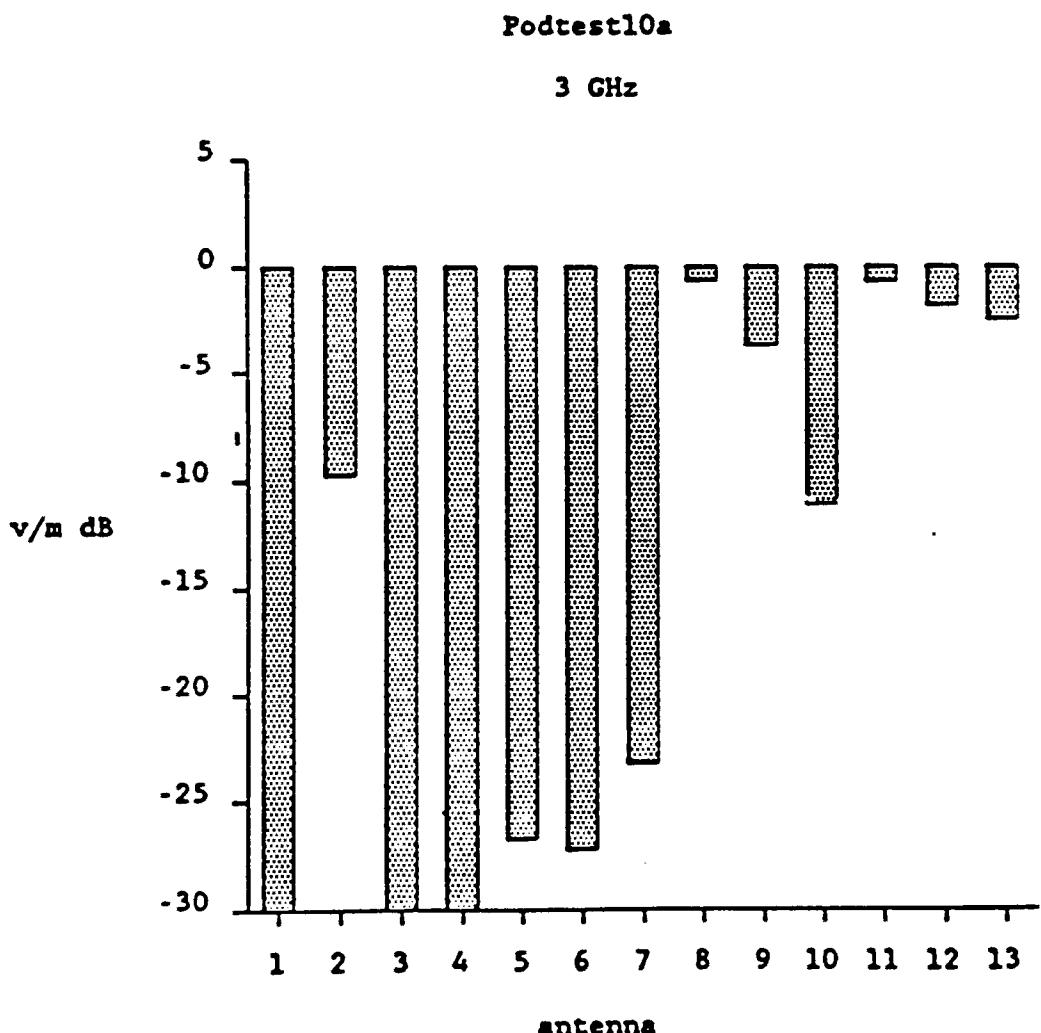
antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-67.080	20.640	317.281	-23.735
2	-50.790	134.649	317.281	-7.445
3	-72.670	14.461	317.281	-26.825
4	-69.850	20.008	317.281	-24.005
5	-71.990	13.938	317.281	-27.145
6	-74.990	10.452	317.281	-29.645
7	-73.560	10.983	317.281	-29.215
8	-63.090	36.661	317.281	-18.745
9	-44.090	291.208	317.281	-0.745
10	-70.230	16.114	317.281	-25.885
11	-29.930	243.448	317.281	-2.301
12	-30.580	213.258	317.281	-3.451
13	-30.660	211.303	317.281	-3.531



Graph 8

Test ID Podtest10a  
 ECM Freq 3 GHz  
 nearest ant 11  
 horn rotat. horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-73.740	9.587	329.947	-30.735
2	-52.780	107.079	329.947	-9.775
3	-82.360	4.739	329.947	-36.855
4	-76.230	9.598	329.947	-30.725
5	-71.220	15.230	329.947	-26.715
6	-72.150	14.494	329.947	-27.145
7	-67.230	22.762	329.947	-23.225
8	-44.700	304.581	329.947	-0.695
9	-46.760	214.142	329.947	-3.755
10	-55.100	91.982	329.947	-11.095
11	-28.000	304.023	329.947	-0.711
12	-28.650	266.321	329.947	-1.861
13	-29.340	245.983	329.947	-2.551



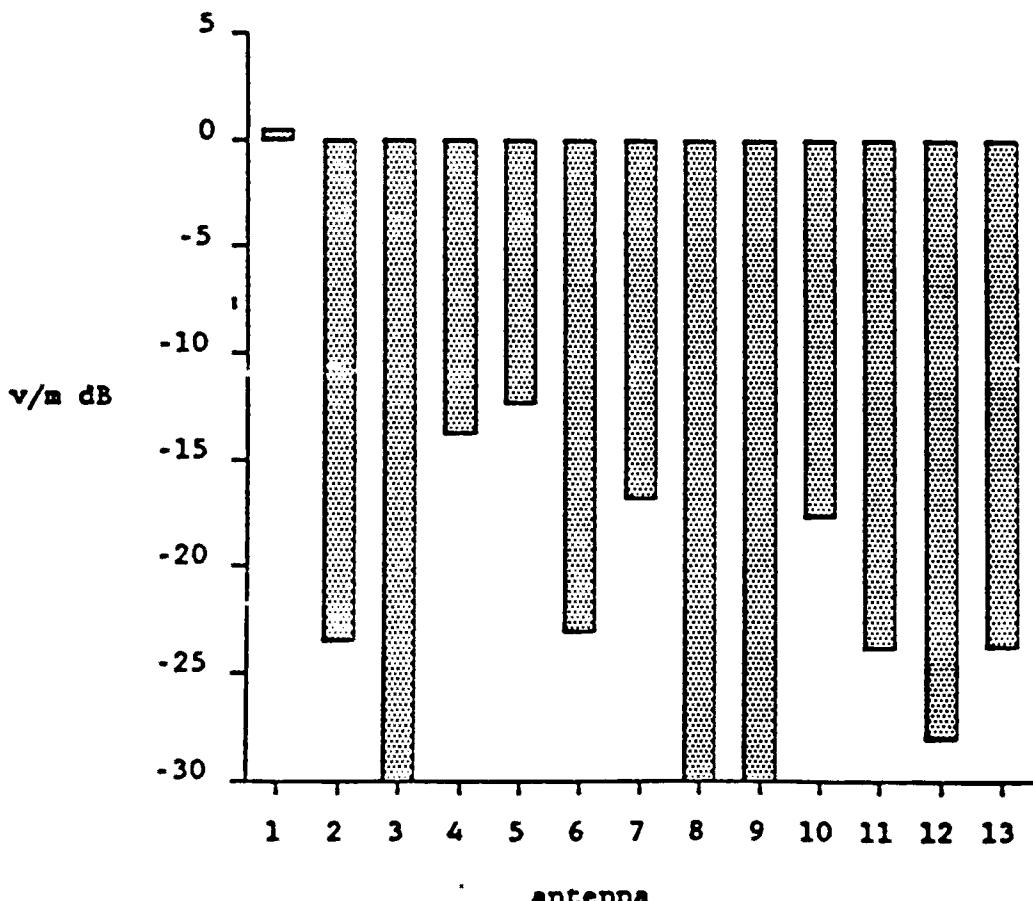
Graph 9

Test ID            Podtest11  
ECM Freq        3 GHz  
nearest ant      11  
horn rotat.     vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-42.670	342.928	323.925	0.495
2	-66.630	21.737	323.925	-23.465
3	-100.000	0.622	323.925	-54.335
4	-59.410	66.558	323.925	-13.745
5	-57.010	78.199	323.925	-12.345
6	-68.210	22.814	323.925	-23.045
7	-60.990	46.688	323.925	-16.825
8	-100.000	0.523	323.925	-55.835
9	-100.000	0.466	323.925	-56.835
10	-01.920	41.947	323.925	-17.755
11	-51.270	20.864	323.925	-23.821
12	-54.950	12.895	323.925	-28.001
13	-50.710	21.009	323.925	-23.761

Podtest11

3 GHz



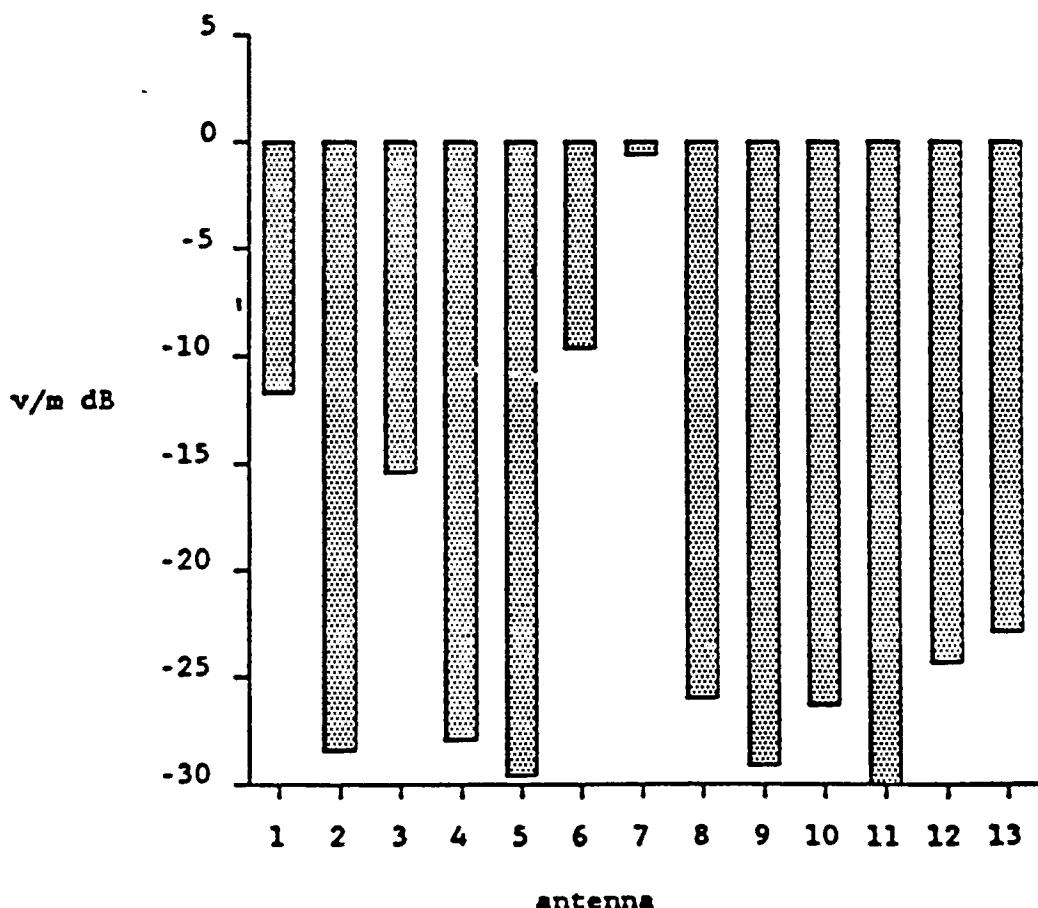
Graph 10

Test ID Podtest12  
 ECM Freq 3 GHz  
 nearest ant 7 & 8  
 horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-54.860	84.276	324.298	-11.705
2	-71.560	12.323	324.298	-28.405
3	-61.130	54.601	324.298	-15.475
4	-73.610	12.978	324.298	-27.955
5	-74.190	10.819	324.298	-29.535
6	-54.780	107.079	324.298	-9.625
7	-44.760	302.484	324.298	-0.605
8	-70.110	16.338	324.298	-25.955
9	-72.220	11.421	324.298	-29.065
10	-70.460	15.693	324.298	-26.305
11	-70.160	2.371	324.298	-42.721
12	-51.310	19.607	324.298	-24.371
13	-49.880	23.116	324.298	-22.941

Podtest12

3 GHz



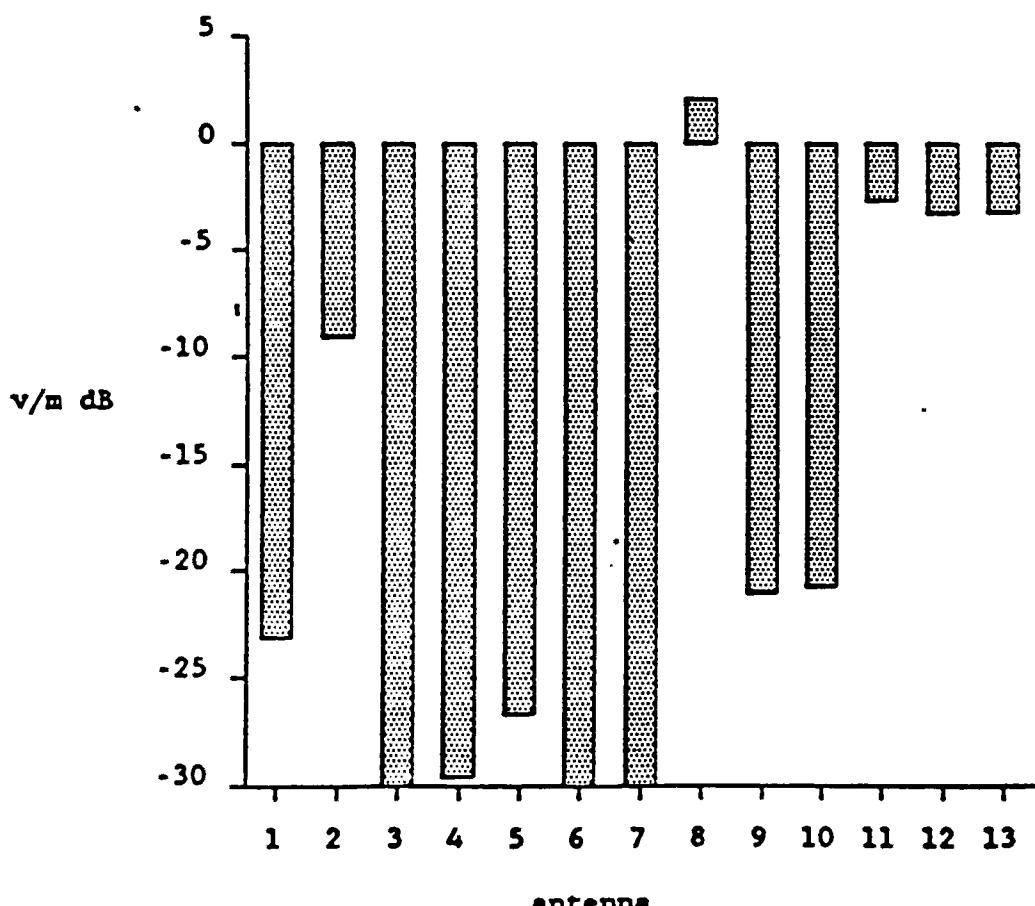
Graph 11

Test ID Podtest13  
ECM Freq 3 GHz  
nearest ant 7 & 8  
horn rotat. horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-66.270	22.657	324.298	-23.115
2	-52.230	114.078	324.298	-9.075
3	-100.000	0.622	324.298	-54.345
4	-75.230	10.770	324.298	-29.575
5	-71.350	15.004	324.298	-26.695
6	-100.000	0.587	324.298	-54.845
7	-78.550	6.183	324.298	-34.395
8	-42.040	413.716	324.298	2.115
9	-64.230	28.655	324.298	-21.075
10	-64.950	29.594	324.298	-20.795
11	-30.160	237.086	324.298	-2.721
12	-30.270	221.007	324.298	-3.331
13	-30.210	222.539	324.298	-3.271

Podtest13

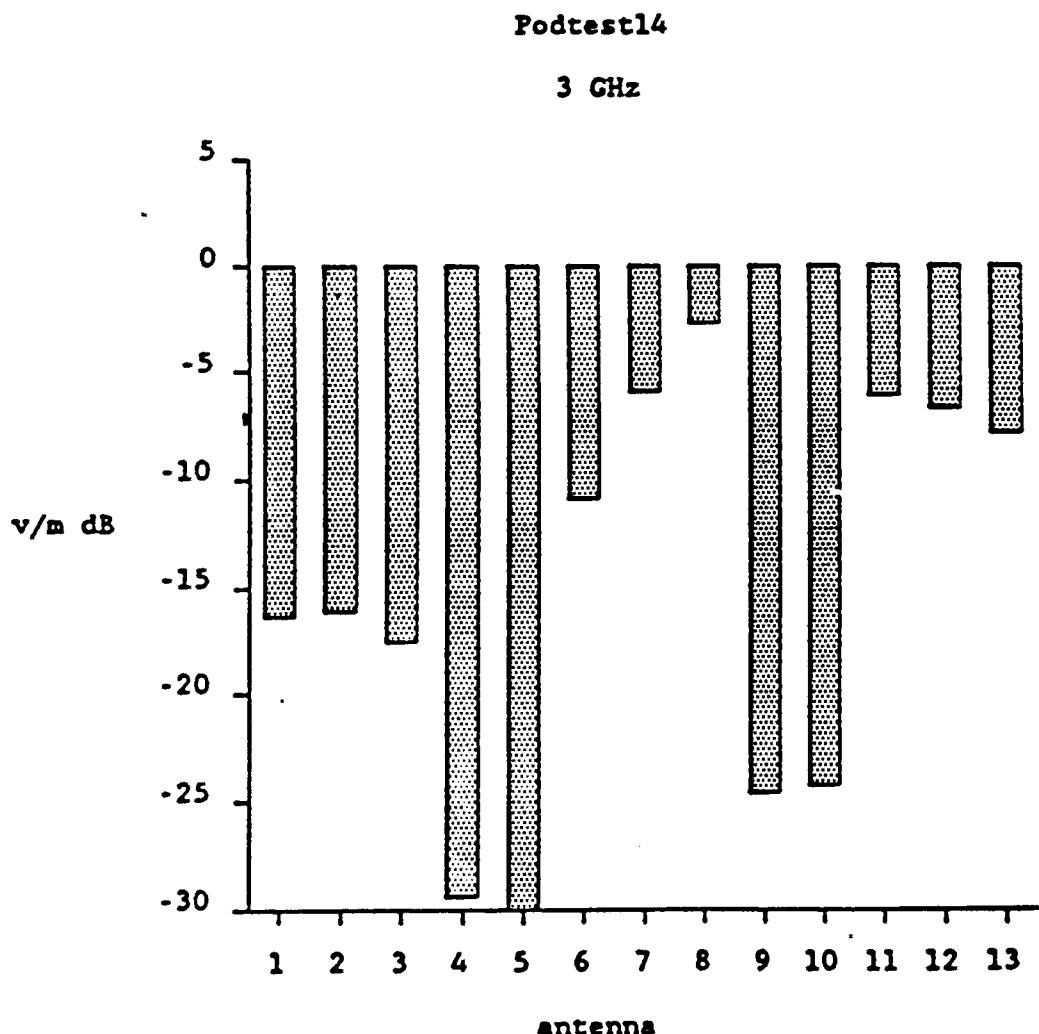
3 GHz



Graph 12

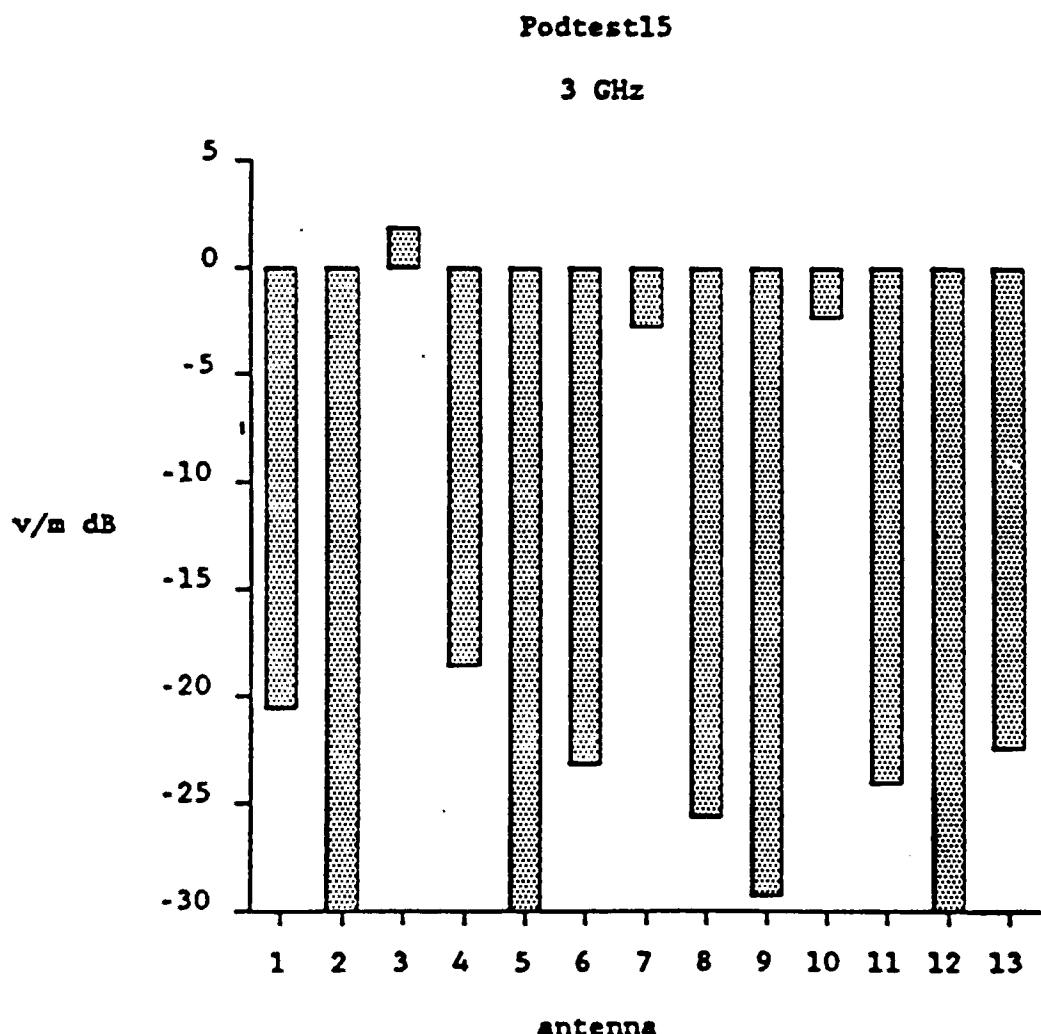
Test ID Podtest14  
ECM Freq 3 GHz  
nearest ant 7 & 8  
horn rotat. 45 Degrees

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-59.450	49.682	325.795	-16.335
2	-59.230	50.957	325.795	-16.115
3	-63.150	43.272	325.795	-17.535
4	-74.970	11.097	325.795	-29.355
5	-75.080	9.766	325.795	-30.465
6	-55.980	93.262	325.795	-10.865
7	-50.040	164.703	325.795	-5.925
8	-46.830	238.343	325.795	-2.715
9	-67.710	19.196	325.795	-24.595
10	-68.370	19.962	325.795	-24.255
11	-33.490	161.587	325.795	-6.091
12	-33.620	150.282	325.795	-6.721
13	-34.780	131.494	325.795	-7.881



Graph 13

Test ID	Podtest15			
ECM Freq	3 GHz			
nearest ant	3 & 4			
horn rotat.	vertical			
antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-63.730	30.353	325.795	-20.615
2	-77.600	6.148	325.795	-34.485
3	-43.800	401.516	325.795	1.815
4	-64.180	38.433	325.795	-18.565
5	-100.000	0.554	325.795	-55.385
6	-68.270	22.657	325.795	-23.155
7	-46.800	239.168	325.795	-2.685
8	-69.690	17.148	325.795	-25.575
9	-72.400	11.187	325.795	-29.285
10	-46.390	250.728	325.795	-2.275
11	-51.480	20.366	325.795	-24.081
12	-68.590	2.682	325.795	-41.691
13	-49.380	24.485	325.795	-22.481



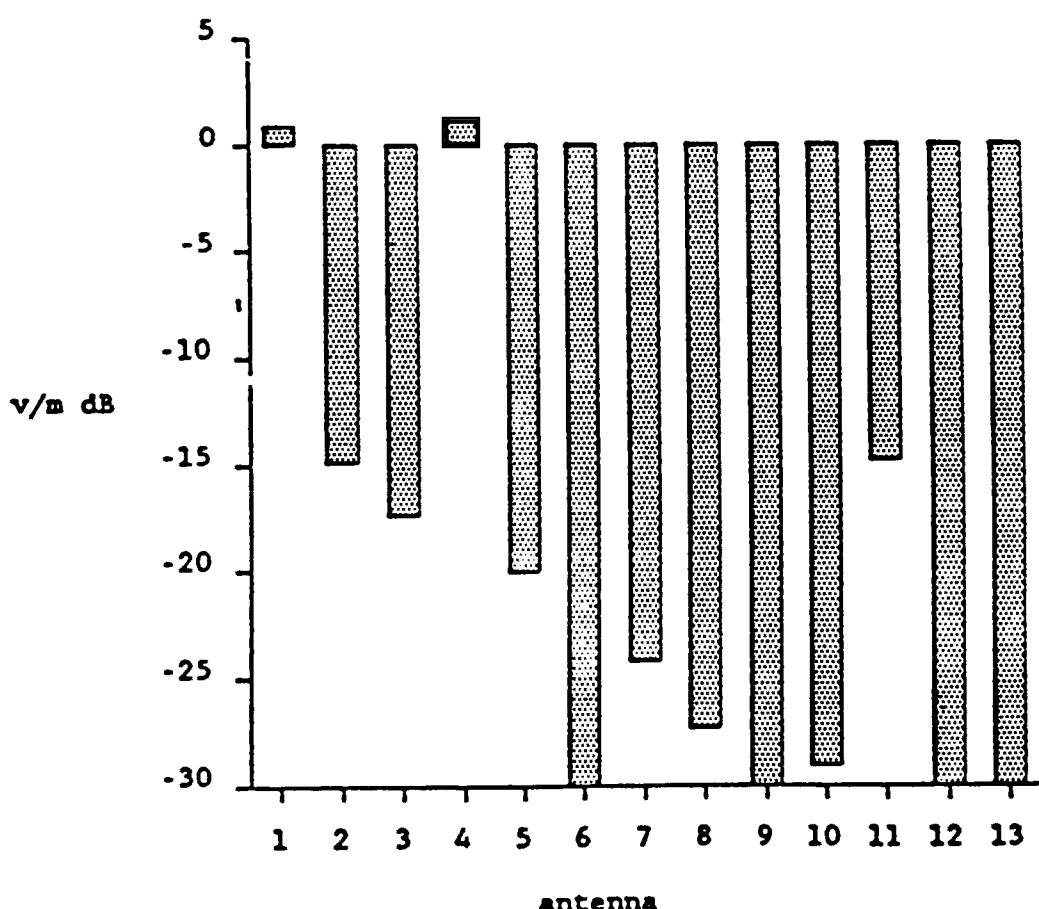
Graph 14

Test ID            Podtest16  
 ECM Freq        3 GHz  
 nearest ant      3 & 4  
 horn rotat.     horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-42.230	360.747	326.170	0.875
2	-58.000	58.709	326.170	-14.895
3	-63.010	43.975	326.170	-17.405
4	-44.500	370.427	326.170	1.105
5	-64.670	32.374	326.170	-20.065
6	-80.130	5.784	326.170	-35.025
7	-68.270	20.193	326.170	-24.165
8	-71.360	14.148	326.170	-27.255
9	-77.520	6.204	326.170	-34.415
10	-73.100	11.580	326.170	-28.995
11	-42.250	58.939	326.170	-14.861
12	-69.690	2.363	326.170	-42.801
13	-58.860	8.221	326.170	-31.971

Podtest16

3 GHz



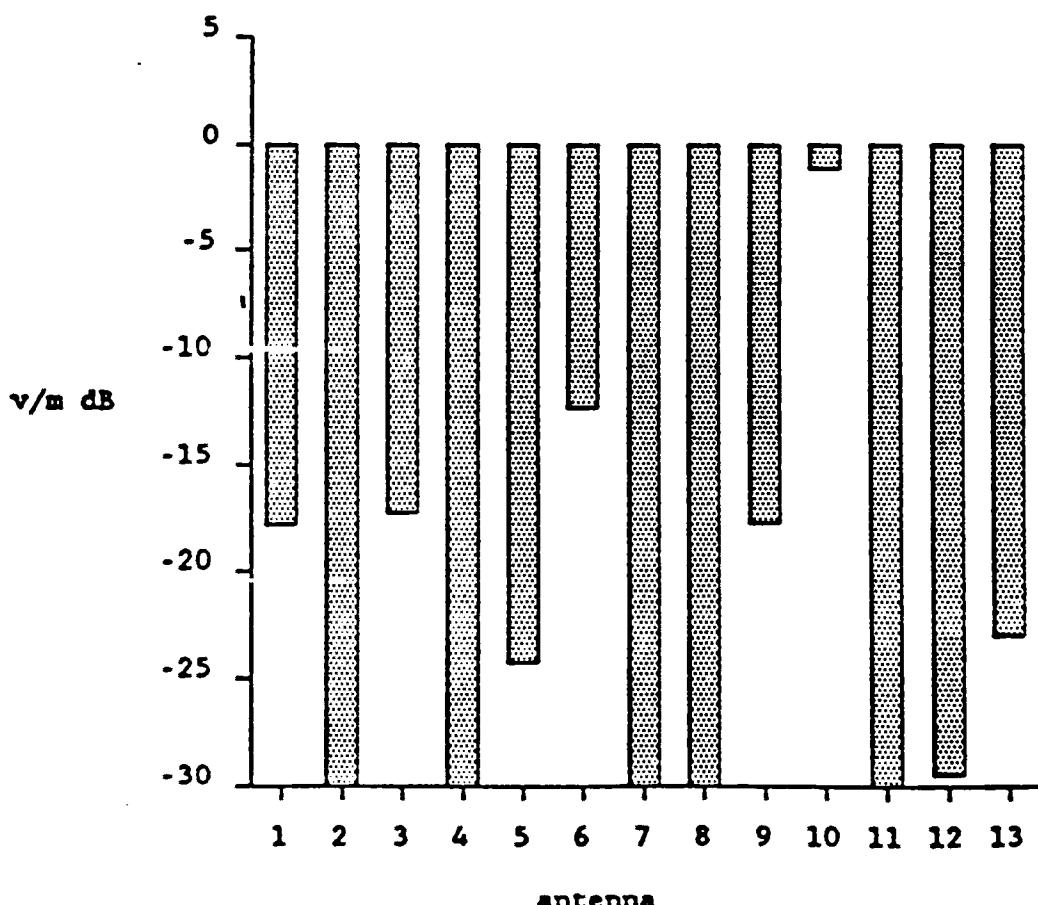
Graph 15

Test ID Podtest2-2  
ECM Freq 3 GHz  
nearest ant 9  
horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-50.580	43.622	339.973	-17.835
2	-71.520	3.915	339.973	-38.775
3	-52.570	46.260	339.973	-17.325
4	-82.200	1.527	339.973	-46.955
5	-58.490	20.855	339.973	-24.245
6	-47.060	82.357	339.973	-12.315
7	-100.000	0.165	339.973	-66.255
8	-100.000	0.165	339.973	-66.255
9	-50.540	43.823	339.973	-17.795
10	-34.900	297.648	339.973	-1.155
11	-54.190	4.714	339.973	-37.161
12	-45.980	11.453	339.973	-29.451
13	-39.550	24.011	339.973	-23.021

Podtest2-2

3 GHz



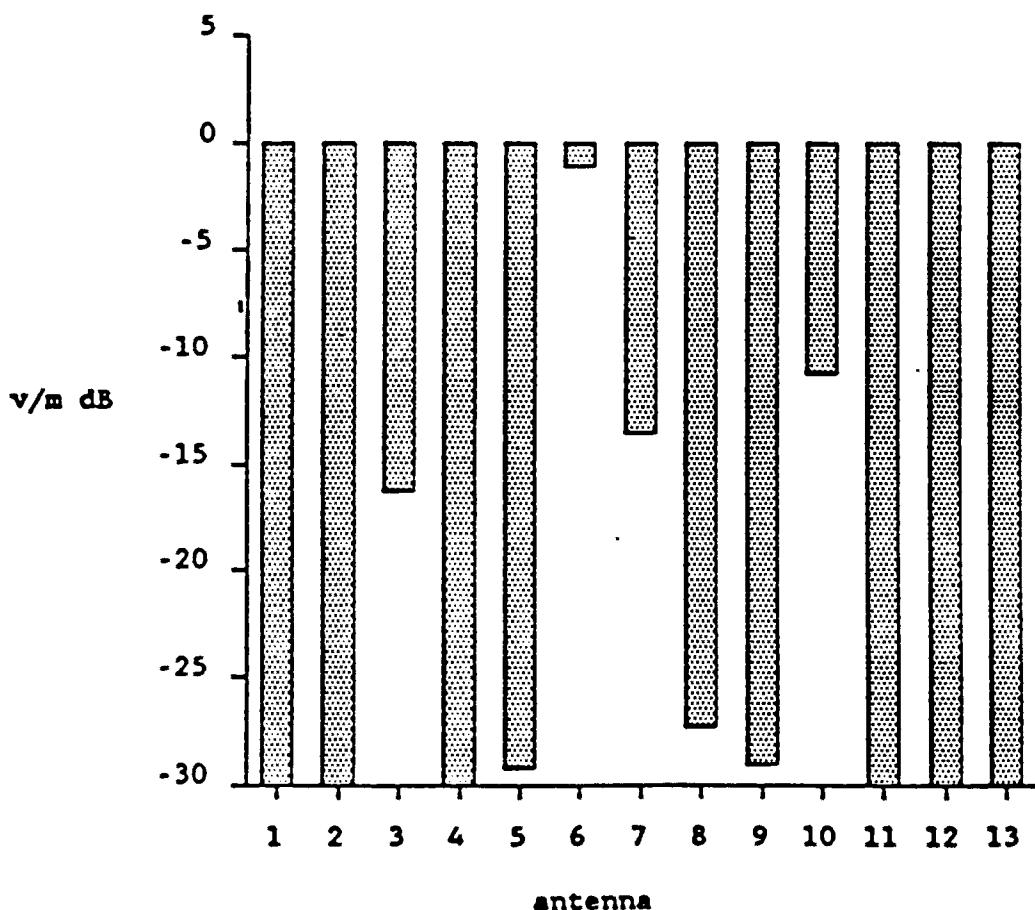
Graph 16

Test ID Podtest2-3  
ECM Freq 3 GHz  
nearest ant 5 & 6  
horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-70.900	4.204	326.170	-37.795
2	-67.140	6.482	326.170	-34.035
3	-51.900	49.969	326.170	-16.295
4	-100.000	0.197	326.170	-64.395
5	-63.830	11.277	326.170	-29.225
6	-36.170	288.538	326.170	-1.065
7	-47.600	68.977	326.170	-13.495
8	-61.370	14.132	326.170	-27.265
9	-62.160	11.500	326.170	-29.055
10	-44.880	94.341	326.170	-10.775
11	-53.500	5.104	326.170	-36.111
12	-63.670	1.494	326.170	-46.781
13	-56.020	3.605	326.170	-39.131

Podtest2-3

3 GHz



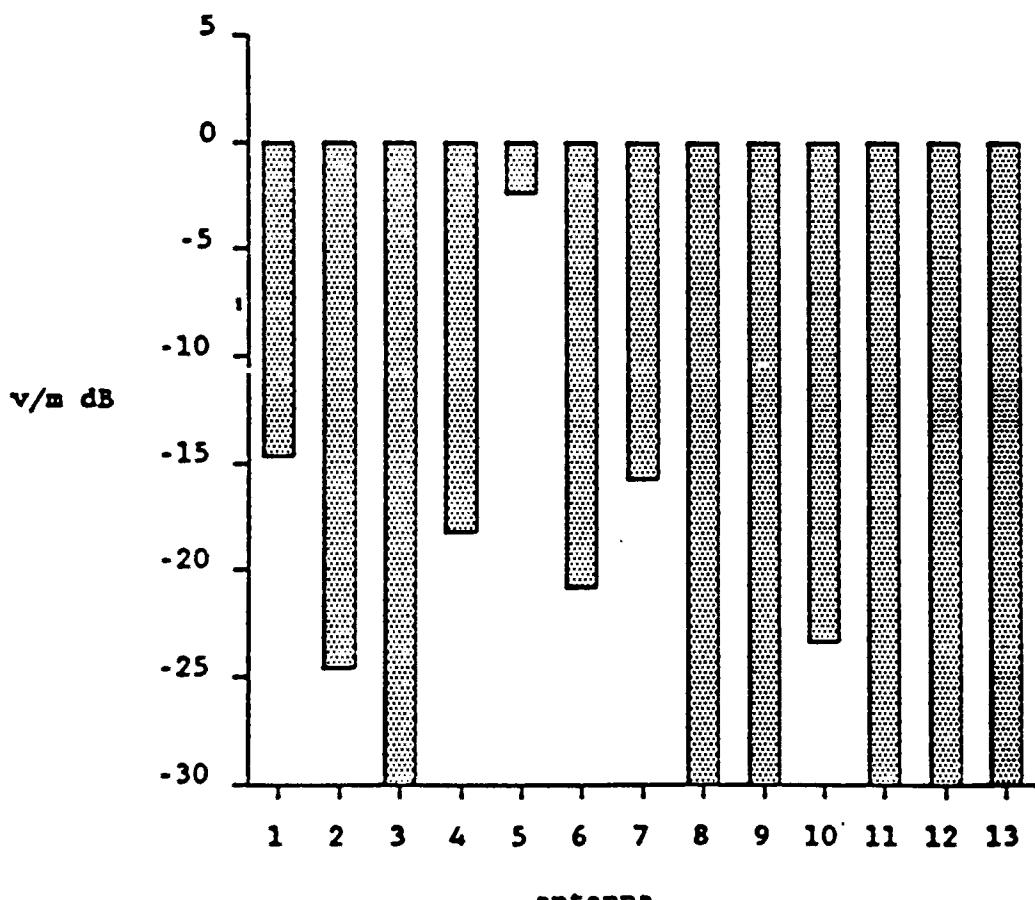
Graph 17

Test ID      Podtest2-4  
 ECM Freq      3 GHz  
 nearest ant      5 & 6  
 horn rotat.      horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-47.740	60.493	327.676	-14.675
2	-57.610	19.418	327.676	-24.545
3	-72.810	4.500	327.676	-37.245
4	-53.830	40.013	327.676	-18.265
5	-36.990	247.858	327.676	-2.425
6	-55.930	29.662	327.676	-20.865
7	-49.830	53.358	327.676	-15.765
8	-70.090	5.178	327.676	-36.025
9	-100.000	0.147	327.676	-66.935
10	-57.430	22.243	327.676	-23.365
11	-49.130	8.441	327.676	-31.781
12	-61.110	2.006	327.676	-44.261
13	-51.150	6.315	327.676	-34.301

Podtest2-4

3 GHz



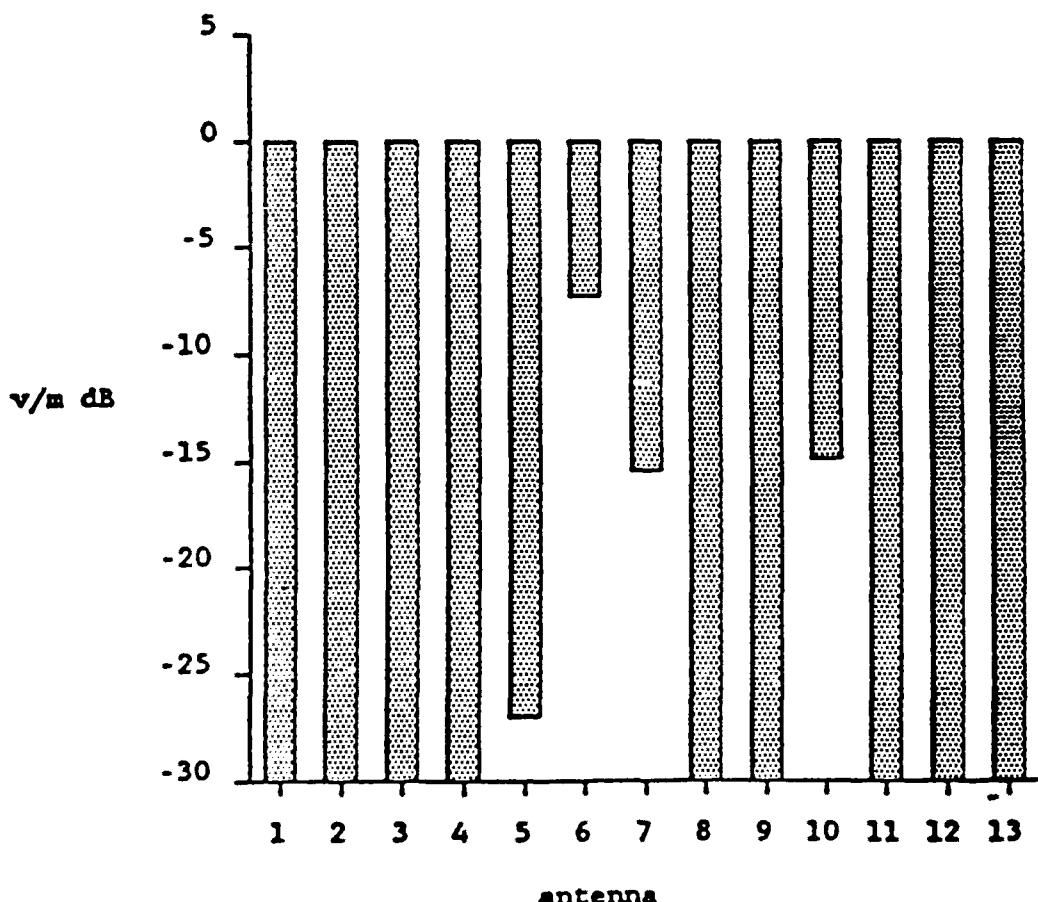
Graph 18

Test ID Podtest2-7  
 ECM Freq 10 GHz  
 nearest ant 5 & 6  
 horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-75.040	3.301	348.293	-40.465
2	-76.210	2.990	348.293	-41.325
3	-73.170	6.954	348.293	-33.995
4	-76.330	4.631	348.293	-37.525
5	-65.730	15.621	348.293	-26.965
6	-46.010	150.214	348.293	-7.305
7	-50.260	58.913	348.293	-15.435
8	-67.070	9.500	348.293	-31.285
9	-66.980	9.445	348.293	-31.335
10	-51.510	62.764	348.293	-14.885
11	-75.320	0.818	348.293	-52.586
12	-77.960	0.512	348.293	-56.656
13	-70.440	1.166	348.293	-49.506

Podtest2-7

10 GHz



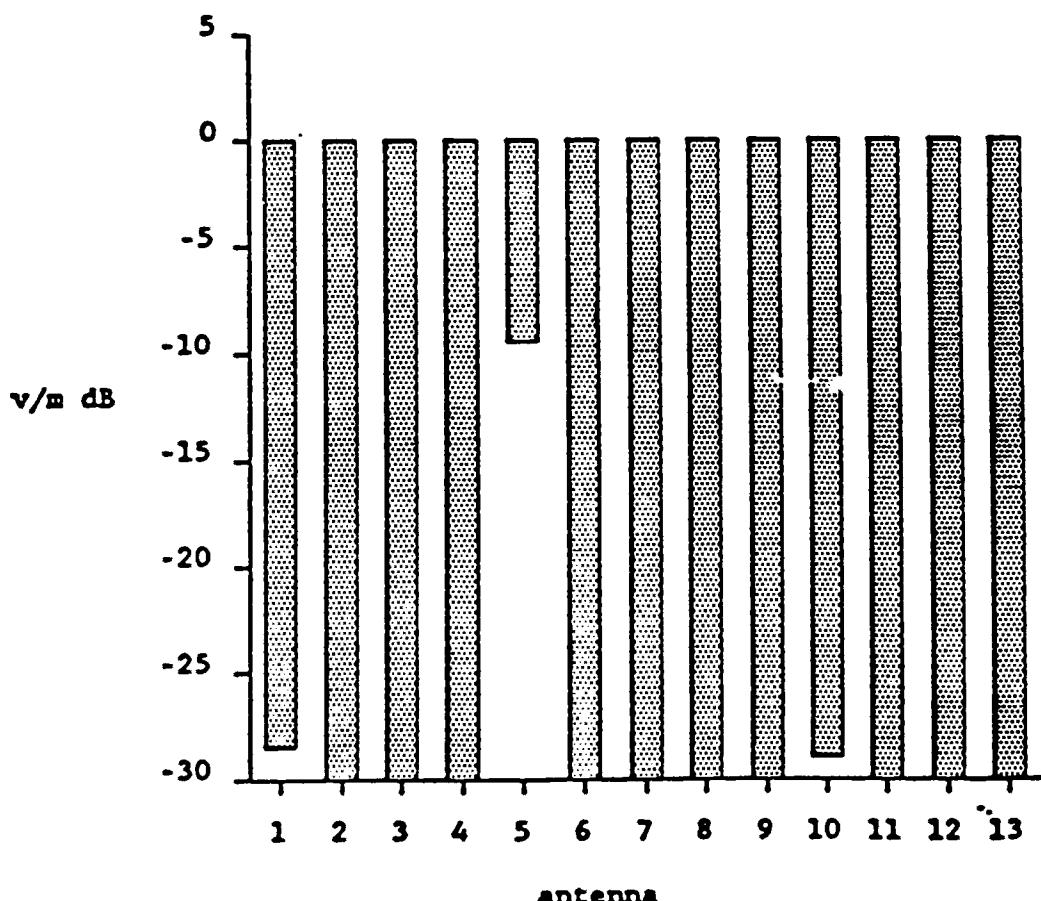
Graph 19

Test ID Podtest2-8a25  
 ECM Freq 10 GHz  
 nearest ant 5 & 6  
 horn rotat. horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-62.130	14.595	388.548	-28.505
2	-100.000	0.193	388.548	-66.065
3	-100.000	0.317	388.548	-61.775
4	-76.490	4.547	388.548	-38.635
5	-47.270	130.831	388.548	-9.455
6	-100.000	0.300	388.548	-62.245
7	-100.000	0.192	388.548	-66.125
8	-100.000	0.214	388.548	-65.165
9	-100.000	0.211	388.548	-65.305
10	-64.650	13.826	388.548	-28.975
11	-67.790	1.946	388.548	-46.006
12	-73.190	0.886	388.548	-52.836
13	-65.530	2.052	388.548	-45.546

Podtest2-8a25

10 GHz



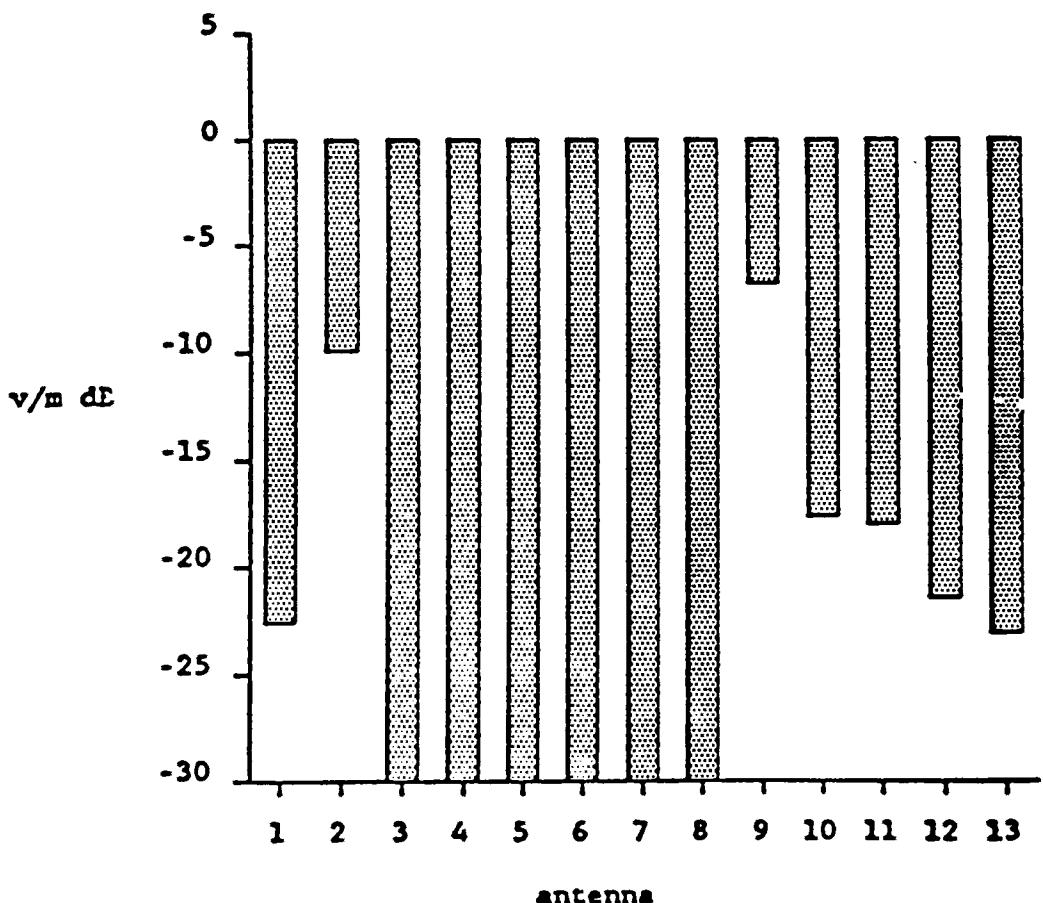
Graph 20

Test ID Podtest2-9a26  
 ECM Freq 10 GHz  
 nearest ant 9  
 horn rotat. horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-56.420	28.165	377.959	-22.555
2	-44.960	109.197	343.514	-9.955
3	-100.000	0.317	343.514	-60.705
4	-76.440	4.573	324.672	-37.025
5	-100.000	0.302	324.672	-60.625
6	-100.000	0.300	324.672	-60.685
7	-73.160	4.219	324.672	-37.725
8	-100.000	0.214	324.672	-63.605
9	-43.010	149.180	324.672	-6.755
10	-54.910	42.434	324.672	-17.675
11	-41.340	40.892	324.672	-17.996
12	-43.420	27.299	324.672	-21.506
13	-44.610	22.811	324.672	-23.066

Podtest2-9a26

10 GHz



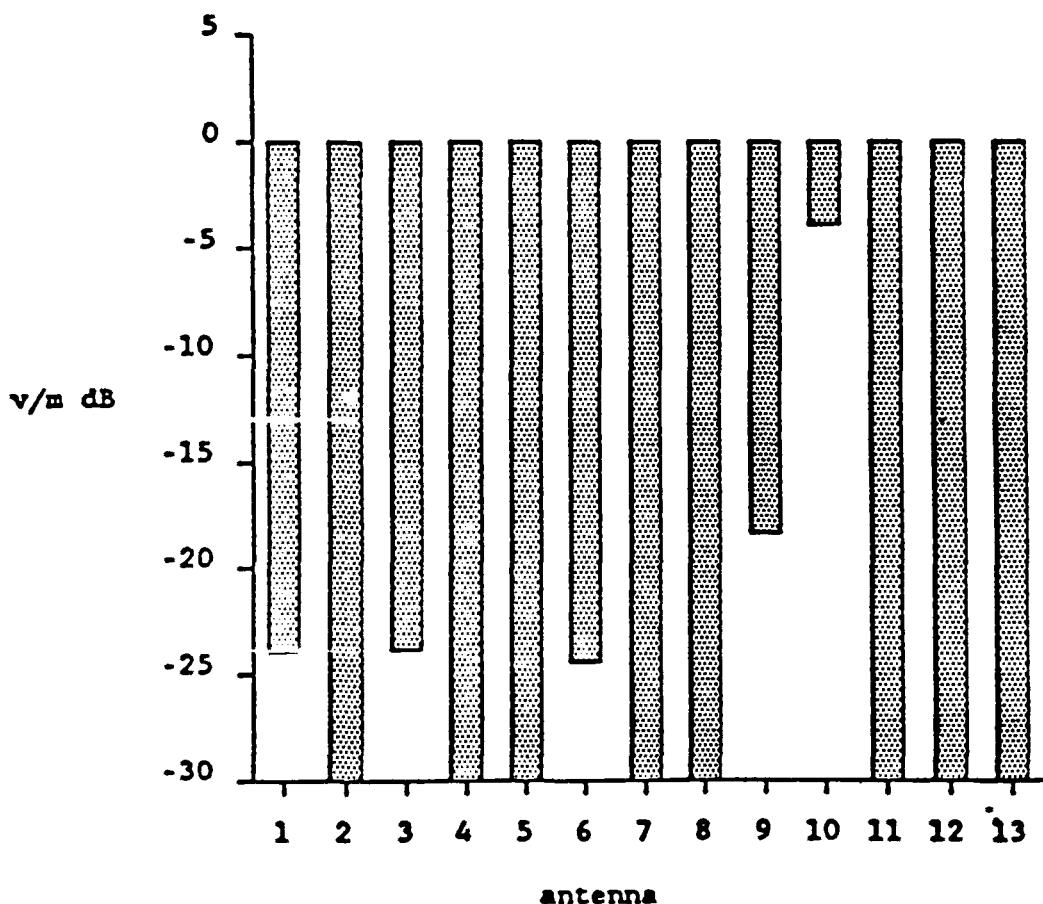
Graph 21

Test ID Podtest2-1026  
ECM Freq 10 GHz  
nearest ant 9  
horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-57.660	24.418	384.986	-23.955
2	-64.960	10.920	384.986	-30.945
3	-62.100	24.872	384.986	-23.795
4	-100.000	0.304	384.986	-62.065
5	-71.490	8.048	384.986	-33.595
6	-62.230	23.212	384.986	-24.395
7	-74.910	3.449	384.986	-40.955
8	-100.000	0.214	384.986	-65.085
9	-53.170	46.314	384.986	-18.395
10	-39.630	246.439	384.986	-3.875
11	-65.540	2.521	384.986	-43.676
12	-57.570	5.354	384.986	-37.136
13	-51.750	10.026	384.986	-31.686

Podtest2-1026

10 GHz



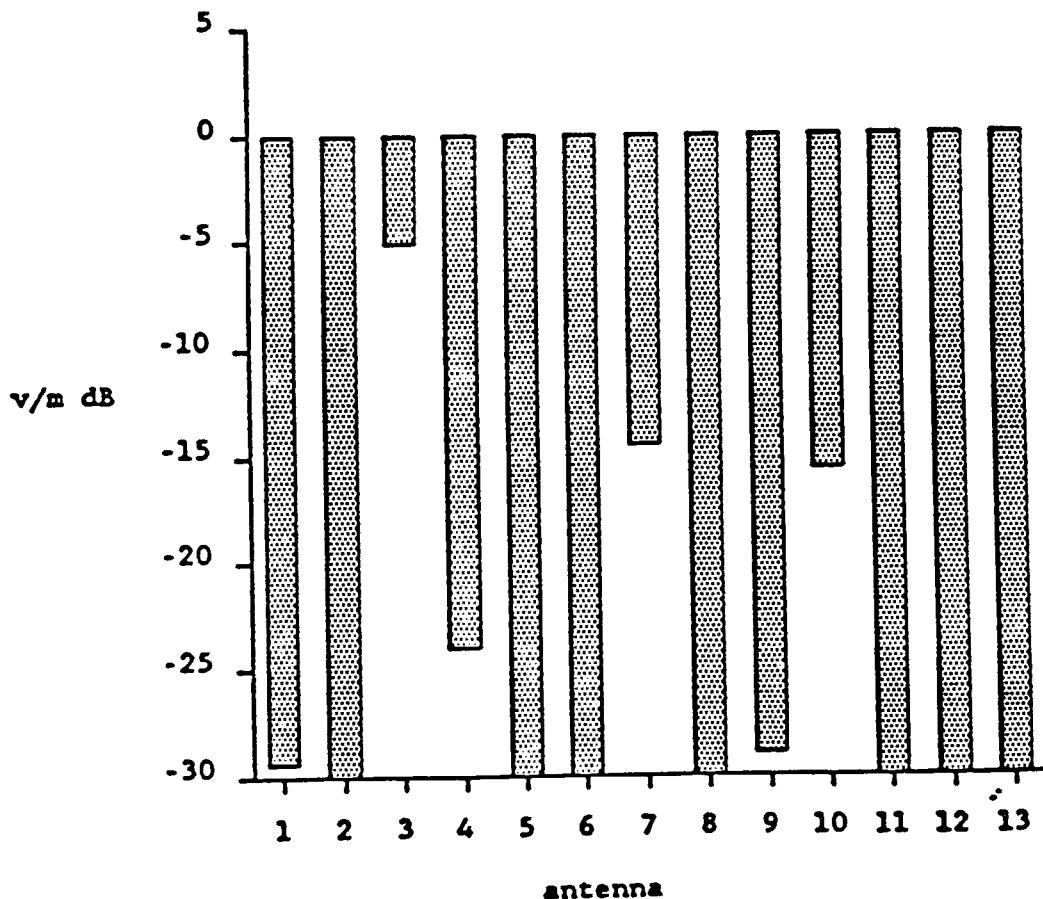
Graph 22

Test ID Podtest2-1126  
 ECM Freq 10 GHz  
 nearest ant 3 & 4  
 horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-62.630	13.779	404.990	-29.365
2	-73.620	4.029	404.990	-40.045
3	-42.980	224.755	404.990	-5.115
4	-61.470	25.628	404.990	-23.975
5	-100.000	0.302	404.990	-62.545
6	-73.060	6.671	404.990	-35.665
7	-47.970	76.685	404.990	-14.455
8	-65.210	11.768	404.990	-30.735
9	-63.310	14.411	404.990	-28.975
10	-50.910	67.253	404.990	-15.595
11	-72.490	1.133	404.990	-51.066
12	-74.620	0.752	404.990	-54.626
13	-76.150	-0.604	404.990	-56.526

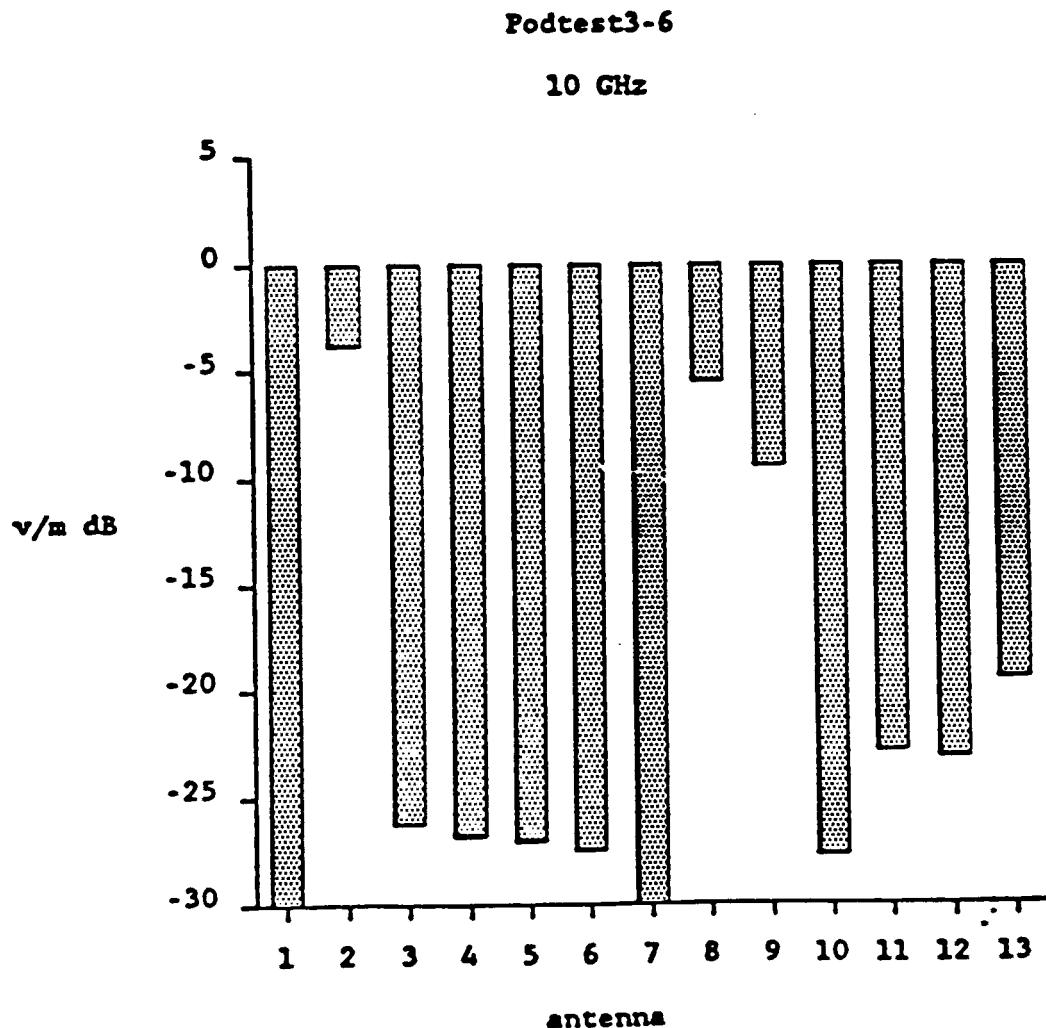
Podtest2-1126

10 GHz



Graph 23

Test ID	Podtest3-6			
ECM Freq	10 GHz			
nearest ant	2			
horn rotat.	horizontal			
antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-63.310	12.741	405.457	-30.055
2	-37.380	261.342	405.457	-3.815
3	-64.050	19.871	405.457	-26.195
4	-64.320	18.459	405.457	-26.835
5	-64.500	17.997	405.457	-27.055
6	-64.840	17.187	405.457	-27.455
7	-64.820	11.021	405.457	-31.315
8	-40.010	214.146	405.457	-5.545
9	-43.780	136.524	405.457	-9.455
10	-63.020	16.681	405.457	-27.715
11	-44.270	29.184	405.457	-22.856
12	-43.140	28.193	405.457	-23.156
13	-39.140	42.820	405.457	-19.526



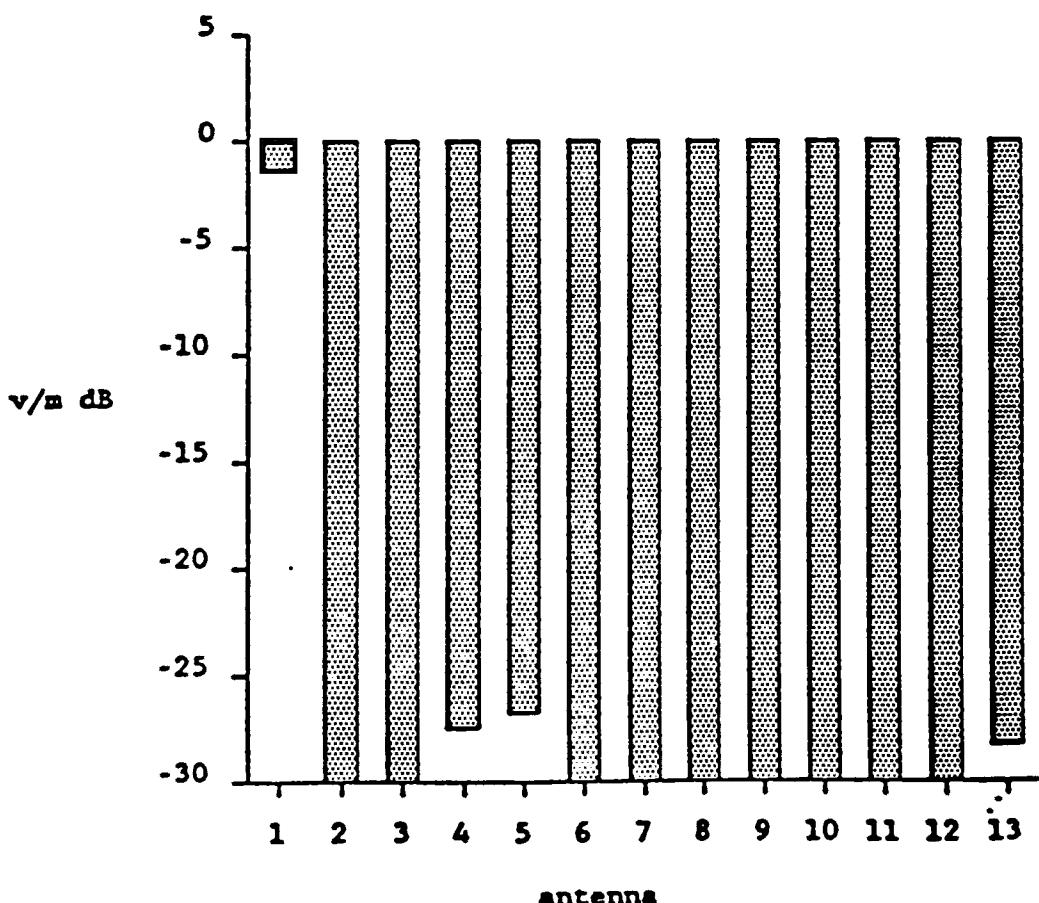
Graph 24

Test ID Podtest3-7  
ECM Freq 10 GHz  
nearest ant 2  
horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-34.660	344.913	404.059	-1.375
2	-75.290	3.324	404.059	-41.695
3	-79.590	3.321	404.059	-41.705
4	-64.930	17.207	404.059	-27.415
5	-64.190	18.651	404.059	-26.715
6	-100.000	0.300	404.059	-62.585
7	-66.970	8.604	404.059	-33.435
8	-64.650	12.552	404.059	-30.155
9	-69.980	6.687	404.059	-35.625
10	-68.760	8.614	404.059	-33.425
11	-64.030	3.000	404.059	-42.586
12	-61.650	3.347	404.059	-41.636
13	-47.860	15.691	404.059	-28.216

Podtest3-7

10 GHz



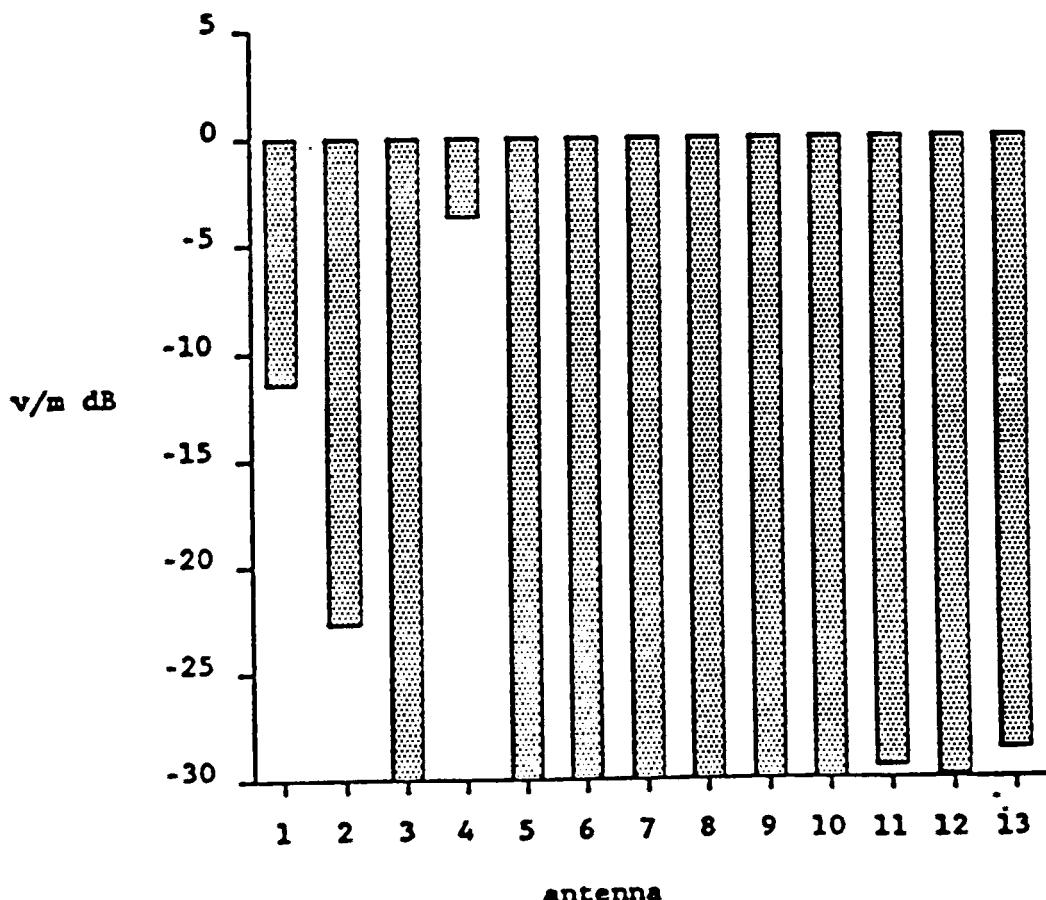
Graph 25

Test ID Podtest3-129  
 ECM Freq 10 GHz  
 nearest ant 3 & 4  
 horn rotat. horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-44.680	108.820	407.328	-11.465
2	-56.280	29.663	407.328	-22.755
3	-72.090	7.874	407.328	-34.275
4	-41.170	265.283	407.328	-3.725
5	-76.230	4.663	407.328	-38.825
6	-75.110	5.269	407.328	-37.765
7	-66.850	8.724	407.328	-33.385
8	-100.000	0.214	407.328	-65.575
9	-100.000	0.211	407.328	-65.715
10	-67.800	9.621	407.328	-32.535
11	-50.840	13.698	407.328	-29.466
12	-49.830	13.051	407.328	-29.886
13	-48.250	15.002	407.328	-28.676

Podtest3-129

10 GHz



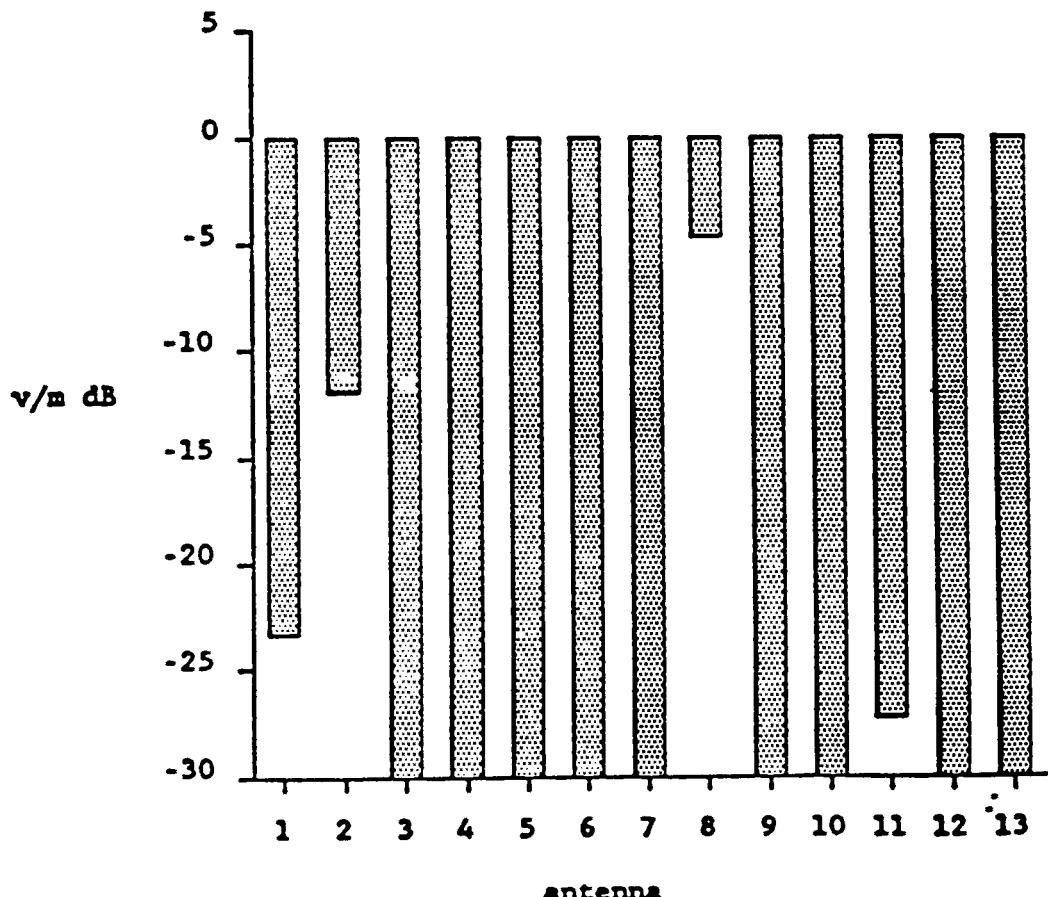
Graph 26

Test ID Podtest3-229  
 ECM Freq 10 GHz  
 nearest ant 8  
 horn rotat. horizontal

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-56.680	27.334	401.277	-23.335
2	-45.600	101.440	401.277	-11.945
3	-100.000	0.317	401.277	-62.055
4	-100.000	0.304	401.277	-62.425
5	-100.000	0.302	401.277	-62.465
6	-100.000	0.300	401.277	-62.525
7	-76.580	2.846	401.277	-42.985
8	-39.270	233.190	401.277	-4.715
9	-71.350	5.711	401.277	-36.935
10	-100.000	0.236	401.277	-64.605
11	-48.750	17.424	401.277	-27.246
12	-51.120	11.250	401.277	-31.046
13	-51.320	10.535	401.277	-31.616

Podtest3-229

10 GHz



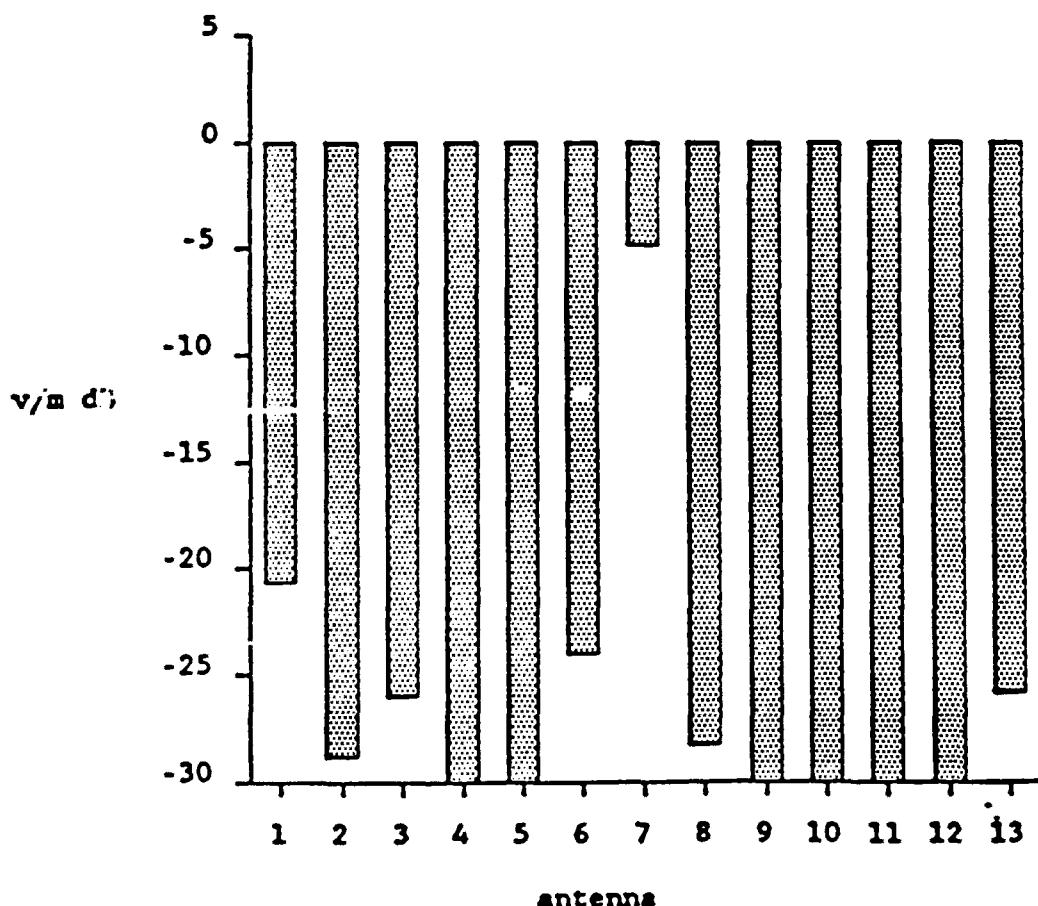
Graph 27

Test ID Podtest3-329  
ECM Freq 10 GHz  
nearest ant 8  
horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-53.920	37.559	404.059	-20.635
2	-62.380	14.696	404.059	-28.785
3	-63.880	20.263	404.059	-25.995
4	-70.520	9.041	404.059	-33.005
5	-71.160	8.360	404.059	-33.685
6	-61.380	25.598	404.059	-23.965
7	-38.410	230.520	404.059	-4.875
8	-62.750	15.621	404.059	-28.255
9	-100.000	0.211	404.059	-65.645
10	-78.740	2.730	404.059	-43.405
11	-60.610	4.347	404.059	-39.366
12	-51.440	10.843	404.059	-31.426
13	-45.480	20.637	404.059	-25.836

Podtest3-329

10 GHz



Graph 28

Test ID Podtest3-530  
 ECM Freq 10 GHz  
 nearest ant 2  
 horn rotat. vertical

antenna	peak pwr	meas v/m	calc v/m	v/m dB
1	-35.850	300.752	412.045	-2.735
2	-59.260	21.048	412.045	-25.835
3	-66.640	14.747	412.045	-28.925
4	-63.010	21.464	412.045	-25.665
5	-64.630	17.730	412.045	-27.325
6	-71.200	8.264	412.045	-33.955
7	-52.880	43.572	412.045	-19.515
8	-61.560	17.915	412.045	-27.235
9	-100.000	0.211	412.045	-65.815
10	-100.000	0.236	412.045	-64.835
11	-61.660	3.941	412.045	-40.386
12	-47.160	17.748	412.045	-27.316
13	-42.980	27.520	412.045	-23.506

Podtest3-530

10 GHz

